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Introduction and Overview

The Nashville Area Metropolitan Planning Organization (NAMPO) inaugurated a study of the movement of freight and the role it plays in the local economy in late 2003. A principal goal of the study is to institutionalize freight needs into the overall NAMPO planning process, by modifying existing planning tools and priorities.

In order to meet this goal, two primary study objectives were established by NAMPO staff:

1. Establish the basis for subsequent freight planning efforts by assembling a regional freight advisory committee and developing a regional freight profile.

2. Produce freight related strategies, policies and projects specific to the Nashville Area that can be implemented within the NAMPO planning process in the near term.

In Phase I, the study team established a Freight Advisory Committee, coupled with efforts toward engaging the private sector in public transportation planning efforts, which were reported on in Technical Memorandum 1. Technical Memorandum 2 described the process, findings, and implications from Research and Field Observations, (Task 2) and was focused on depicting logistic needs of major employers in the Region. Technical Memorandum 3 discussed freight issues in the Region as they pertain to regional land use and air quality in the Nashville Area. This document, Technical Memorandum 4, summarizes the issues relevant to the Nashville Area based on previous field work and research, and presents policies and strategies as opportunities for meeting freight transportation needs in the planning process. The chart in Exhibit 1 below summarizes the study plan.

Exhibit 1: Nashville Regional Freight: Plan of Study

- Task 1: Develop Freight & Goods Movement Committee
- Task 2: Research & Field Observation
- Task 3: Report Presentation
- Phase I: Freight Profile of the Region
- Strategic Development
- Phase II: Build on Phase I Recommendations
The NAMPO includes Davidson, Rutherford, Sumner, Wilson, and Williamson Counties. The study region further extends to the cities of Springfield and Spring Hill in Robertson and Maury counties, with their important industrial production. Exhibit 2 displays the geographic area of the study.

The NAMPO functions under a committee structure comprised of an Executive Board and Technical Coordinating Committee (TCC). The Executive Board consists of elected officials representing Davidson, Rutherford, Sumner, Wilson, and Williamson Counties, as well as cities in those counties with a population of over 5,000. Additional board members include the Governor and an elected official from the Greater Nashville Regional Council. The Board provides policy direction and a forum for transportation and air quality decisions. The Board meets monthly to approve major planning reports and documents.

The Role of Transportation in the Modern Economy

In today’s global society, commercial transportation has become crucial to a region’s business and industrial development potential. For many industries, economic competitiveness is defined by the ability of goods and services to be transported in a time-definite manner. And, while a well-functioning commercial transport system is largely responsible for the modern quality-of-life attributes that consumers’ value; for most consumers commercial transport is an invisible process manifested only by big, intimidating trucks and loud, cumbersome trains that threaten their own timely commute.

In the current business environment cost effective, time sensitive transportation services are increasingly a strategy for competitive advantage in manufacturing and service based industries.
To attract economic development in this new environment, planning agencies must understand and support new economy transportation needs. There are a number of important changes currently taking place within the economy of the United States that have significant implications for any long range transportation planning effort:

- The globalization of trade
- Migration from a manufacturing economy to a service economy
- The evolution of business logistics

**The Globalization of Trade:** Global integration of the U.S. economy has grown at a rapid pace over the past several decades as displayed in Exhibit 3. U.S. manufacturers now shop the world for components and subassemblies to manufacturing processes. Advances in technology and management practices are also allowing U.S. firms to develop strategies that enable customized products for mass market distribution.

The growth reflected in this chart is attributed to three major trends:

- Liberalization of world trade policies that have allowed industries and nations to benefit from trade as a source of economic growth;
- The globalization of supply chains resulting from industries seeking out cost and market advantages that are offered by different parts of the world;
- Advanced information technologies that allow disparate elements of supply chains and distribution channels to be better integrated in time and space.¹

This evolving business environment and associated impacts on transportation networks also has significant implications for regional and local economic development. Robust growth in Nashville’s economy and population over the past several decades is now putting pressure on the Region’s transportation system, resulting in unwanted externalities and unforeseen consequences; traffic congestion is growing, air quality is declining and industrial land use patterns are shifting away from the center of the city.

**Migrating from a Manufacturing Economy to A Service Economy:** Nashville wants to attract and maintain quality employment for its citizens. As in most of the country, some shift away from high paying manufacturing jobs has occurred, and there is a strong desire to replace these

jobs with others with equivalent wage potential. The ability to move freight freely in the Region is critical to bringing new industry to the area.

Because of its central location and range of access, Nashville has developed a diverse economy. Employment data show that the medical facilities are the key employer in the area. In addition to those facilities, Nashville boasts a thriving publishing industry, not just for music and video but for printed materials as well. This market segment has the need to get products out quickly, including CDs, videos, books, and periodicals. Middle Tennessee has been able to attract two large automobile manufacturers. Nissan and Saturn are both important entities in the regional economy and their growth has been one of the most significant economic events of the last 20 years. The automotive industry was the first in this country to develop the concept of “just-in-time” transportation and has a long history of service sensitivity with respect to transportation. The electronics assembly operations at Dell are heavily dependent on transportation infrastructure, as the company’s business model moves technical components into the consumer market rapidly, avoiding the cost of obsolescence. In fact, Dell has risen to the top of its industry, not because of manufacturing capability but because of its logistics prowess.

The Evolution of Business Logistics As U.S. industries become increasingly reliant on international trade U.S. companies are adopting modern supply chain management techniques with the following attributes:

- **Customer-Focused Logistics**: Tailoring the logistics system so that it responds to the needs and potential profitability of each specific group of customers.
- **Transportation Effectiveness**: Leveraging the ability of integrated transportation to improve customer service and total supply chain cost performance.
- **Working Capital Management**: Maximizing the productivity of inventory, accounts receivable, and accounts payable.\(^2\)

Under the integrated model of supply chain management, businesses often integrate transportation as part of their product offerings. To succeed businesses are employing just-in-time and other precision based inventory management approaches. Enterprises today tend to

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have minimal “emergency” stockpiles and hence any shortages in the inventory management system may lead to missed sales opportunities or a temporary plant shutdown. The freight, goods and services transport system is vital to regional mobility and productivity, and ultimately economic development. As a result, an efficient and cost effective transport system is vital to the competitive position of businesses and industries competing in a global economy.

According to those who track logistics costs, the average inventory carrying costs for U.S. business has declined from 8.3% of Gross Domestic Product (GDP) in 1981, to just 3.8% of GDP in 2000. These trends in logistics management are sometimes characterized as moving from “push logistics” to “pull logistics.” Whereas manufacturers used to schedule production runs and push the resulting products into customer markets; today, products are pulled from the manufacturing process using advanced communications and point of sale information.

Nashville: A Crossroads to National and International Markets

Nashville occupies a strategic location within North America. It is within 650 miles of half the U.S. population and sits at the nexus of major highways and rail routes. Nashville’s location has made it a transportation hub with a wide range of resources essential to moving products and people. Its position as a crossroad city brings to Nashville a set of challenges in dealing with the various aspects of traffic, particularly highway congestion and air quality, as their major sources originate outside of the area. The need to influence the overhead flow of through traffic becomes a clear priority for a metropolitan area wishing to control its own development destiny.

Nashville has an excellent distribution network at hand with highway, rail, air, and barge facilities all readily available. Three major U.S. interstate highways intersect in Nashville: I-40, I-65, and I-24. The area is served by numerous freight carriers with terminal locations throughout the metropolitan area and beyond. The Cumberland River provides full river barge access to the Gulf of Mexico. CSX Transportation serves Nashville with a major classification yard as well as container, automotive, and bulk terminals. Companies who arrange freight transportation on behalf of local businesses are also active in the Region.

Nashville’s freight infrastructure carries significant tonnage of traffic through the year. The total volume is just short of 300 million tons. While all four modes of transport – truck, rail, water, and air - are represented, trucking far surpasses others in volume. Of the total tonnage moving in the Nashville Region, 87% is moving by truck. Rail service moves a substantially smaller volume at 11% of the total, and water and air have lesser volumes. Exhibit 4 shows the breakdown of tonnage by mode.

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A substantial portion of the total freight traffic traversing the Nashville Region is “through traffic” with no origin or destination in the area. Nearly 80% of truck and rail tonnage combined is through traffic. Looking just at tonnage based in the area (excluding through traffic), Nashville is a medium sized freight market with a typically heavy reliance on the truck mode: 81% of area-based tonnage moves by truck, which is slightly above the 79% national average. The rail share of this volume is half the U.S. average, but that is common in markets where the water mode also is active. The Nashville Area supports over 47,000 trucks per day. The majority of trucks by unit count are classified as through traffic – just over 34,000. The smaller inbound and outbound volumes are fairly well matched - in the neighborhood of 11%.

**Truck Freight**

Two-thirds of truck traffic passes through Nashville rather than originating or terminating in the area. This is apparent in the visual presentation of the network map shown in Exhibit 5, which depicts the annual flows for “through” truck traffic passing through the Nashville Region.

The need for through traffic management creates a distinct requirement for cooperation with other cities within Tennessee and with neighboring states, in the formation and implementation of rail and highway development plans. States surrounding Tennessee have the ability, through their individual policy decisions, to influence the volume of traffic in the Nashville Area. It is therefore incumbent on area planners to be involved and attentive to the projects in surrounding regions. In fact, the interests of other MPO groups are directly in line with those of the Nashville Area, as through traffic is an issue across the state. These common interests suggest the need for organizations to ally, in seeking comprehensive solutions to transportation and air quality challenges.

To understand the effect of trucking on infrastructure in the regional network, truck volumes were also examined in terms of number of units, or trucks. The chart in Exhibit 6 shows trucking volumes by weight and shows the equivalent number of vehicles in the framework of a daily count. The TRANSEARCH database that is the source of

<table>
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<th>Class of Traffic</th>
<th>Annual Truck Volume</th>
<th>Daily Trucks</th>
<th>% of Total</th>
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<tr>
<td>Local</td>
<td>600,000</td>
<td>1,609</td>
<td>3%</td>
</tr>
<tr>
<td>Inbound</td>
<td>2,100,000</td>
<td>5,669</td>
<td>12%</td>
</tr>
<tr>
<td>Outbound</td>
<td>2,000,000</td>
<td>5,401</td>
<td>11%</td>
</tr>
<tr>
<td>Through</td>
<td>12,600,000</td>
<td>34,485</td>
<td>73%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17,200,000</strong></td>
<td><strong>47,164</strong></td>
<td><strong>100%</strong></td>
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4 Conversion from tonnage to vehicles is calculated by applying an average payload for classes of goods by truck equipment type – an example might be the average weight of bulk chemicals in a tank trailer. TRANSEARCH portrays the tonnage volume of goods by equipment types, and payload information comes from industry sources, and the federal Vehicle Inventory and Use Survey.
this profile will undercount the strictly local activity of some types of trucks – it will not capture service vehicles, for example, or municipal waste, or some segments of construction volume. Allowing for this, the proportion of through trucks in the Nashville Area is probably closer to two-thirds than three-fourths, but it is nonetheless is a large volume. Moreover, compared to the average for urban markets around the country, Nashville has double the proportion of through trucks, and ranks among the nation’s top metropolitan areas for its sheer quantity of through truck traffic.5

Trucks moving through the area travel primarily on the interstate highway system. The crossroads aspect of Nashville is clear in the view of that movement; Exhibit 7 shows the direction of that through traffic and how its direction shifts when it reaches the Nashville Area.

Exhibit 7: Directional Flow Volumes of Through Truck Traffic

This map specifically shows the flow of through trucks moving into and out of the Nashville Metropolitan Region. The largest truck volumes are on I-24 moving from Northwest to Southeast. The second highest volumes are on I-40 moving West to East. The figures imply:

- I-40 gains about 3% of the total departing through traffic, as it moves west through the city;
- I-24 gains about 2% of the total departing through traffic, as it moves toward the southeast;
- I-65 loses about 5% of its traffic through the city going south, and gains 4% moving north.

5 The 12 million through trucks seen annually in the Nashville area would rank among the top ten metropolitan regions in the country, as measured by TRANSEARCH using BEAs (Business Economic Areas) to define the metro regions. This ranking would hold whether Nashville itself is defined by its MPO area, or by the larger area of its BEA. According to this same set of measures, about 30% of the total truck volume in the average urban area is represented by through traffic.
This profile has implications for the development of by-pass routes, and for the management of the major intersections of these interstate highways. It will be important in further work to understand this flow and to develop plans around it.

The map in Exhibit 8 shows the non-interstate routes used most heavily by trucks operating in the Region, according to interviews with carriers and shippers. As the centers of commerce move outward, congestion follows. The major area of employment and commerce remains at the center of the city but the employment dispersion map shown below clearly indicates the movement out along spokes emanating from the center.

Exhibit 8: Regional Roadway Use and Key Employment Locations

Through truck traffic is a significant portion of the overall truck volumes, but does not overshadow the need to understand and plan for regional traffic development and its influence the area economy. Trend data for the Nashville Area shows population moving away from the city center and Davidson County, with significant growth in surrounding counties. The shift of employment in the same directions is both a cause and an effect of the population trends. The development of automotive facilities in the outlying areas has been a significant economic event.

The four key employment groups, automotive, publishing, health care, and electronics are shown dispersed along these routes. It is possible to see from this map the dependence of critical
industry on these particular elements of infrastructure. It is also possible to see the ring roads that were formerly the “by-pass” system, and the degree to which they have become commercial centers. Similarly, the radial routes are displaying more activity along their length.

As part of the study effort, “industry clusters” for several key industries were developed to examine the relationships between regional truck flow patterns and major industries. The industry cluster concept uses an understanding of business linkages among industries as the basis for planning. Following is a typical definition for an industry cluster:

“A group of business enterprises and non-business organizations for which membership within the group is an important element of each member firm's individual competitiveness. Binding the cluster together are "buyer-supplier" relationships, common technologies, common buyers or distribution channels, or common labor pools.” 6

For freight transportation planning, industry clusters can be examined to understand the strategic relationships between firms that are commonly dependent on policy-sensitive factors such as technology, geography, infrastructure availability, workforce preparedness and other resources. A transportation-focused industry cluster analysis offers a cohesive view of how the geographic, technological, operational and strategic assets of Nashville’s economy can be leveraged with transportation planning to support economic vitality by facilitating efficient trading relationships.

**Motor Vehicles and Equipment Cluster:** The automotive cluster was developed using previous research conducted for the Tennessee Department of Economic and Community Development by the University of Knoxville.7 Thirty-one industries were identified that were related to the Motor Vehicles and Equipment cluster at the six digit level of the North American Industry Classification System (NAICS). (For additional details see Tech Memo 3).

Firms within the Nashville Region that are members of the automotive cluster are illustrated in Exhibit 9. (Note the dots on this map do not represent firm size by level of employment). The previous map showing firm size for major industries by employment clearly showed the location of the Saturn and Nissan plants in Maury and Rutherford Counties. The cluster map

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suggests that significant clusters of related firms (and likely suppliers) are located near the core downtown area of Nashville and near the center of Robertson County. This spatial concentration of manufacturers relative to supporting industries may affect the number of intra-regional truck trips occurring in support of the automotive industry on a daily basis. In the future, a more formalized value-chain cluster study may further explore this relationship and its associated challenges and opportunities.

Exhibit 10: Printing and Publishing Industry Cluster

*The Printing and Publishing Industry Cluster:* The cluster industries in the Printing and Publishing group were derived from a similar study conducted in the Minneapolis/St. Paul region. Ten related industries were identified as inter-related to printing and publishing. A map of the Printing and Publishing cluster is displayed in Exhibit 10. The printing cluster is heavily concentrated in the center of Nashville, reinforcing a trend in the industry toward more centralized distribution which was discussed in detail in Tech Memo 2. However, as noted in that discussion publishing is a very time sensitive industry, often with pick-up and delivery (PUD) windows measured in minutes. If congestion continues to grow in the core area of Nashville, new strategies will likely be required to maintain PUD reliability.

**Rail Freight**

Traffic in the freight rail system in the Nashville Area is shaped by the position of Nashville in the eastern and national rail network, and by the structure of the network itself. Ownership, connection, and distance combine to influence the pattern and character of current and prospective freight volume. Nashville is a crossroads for rail as it is for the highway, and it carries a substantial burden of tonnage. Even so, the ability of rail to further relieve the highway, and mitigate congestion, is constrained by network position, capacity ceilings, and institutional factors. These limitations are explained and discussed below.

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8 Minnesota Department of Transportation: *The Economic Component of the Metro Freight Study*, January 1999.
Nashville is served by a single Class I railroad: CSX Transportation, and its related intermodal unit. Class I roads are the primary freight haulers of the country, accounting for over 90% of railway revenue. In practical terms, there are seven of them in the U.S. and Canada, and all are private enterprises who own their networks. The U.S. is served mainly by four, with two independent systems generally west of the Mississippi River, and two east. This dividing line is significant for Nashville, since the ‘gateway’ or border of system ownership lies some 200 miles from the metropolitan area, which in railroading is a short distance.

The orientation of CSX lines in Tennessee is chiefly north-south, with a spur west from Nashville to Memphis, but none eastward. A second Class I road, the Norfolk Southern (NS), has a network orientation running northeast-southwest. The NS has a curving east-west line between Memphis and Knoxville via Huntsville, AL and Chattanooga, skirting Nashville and lying over 100 miles to the south.

Large railroads have limited interest in traffic below 500 miles, for reasons including comparative return on capital resources (revenue is strongly related to distance) and modal competitiveness. There are two practical implications to this combination of facts:

- Eastern and western railroads interchange traffic at the Mississippi gateways. The total distance of a traffic lane may be well in excess of 500 miles, yet if the distance to the gateway is abbreviated for one of the parties, their revenue and interest is diminished, just as if the traffic were short-haul business. This is the so-called ‘watershed’ issue. When a railroad has a long distance lane on its own lines while it’s interchange partner’s is short, the first road often reaches across the gateway into the other’s territory with trucks, instead of with a through rail movement. In addition, interchange service typically is weak, and can be uncompetitive with highway service in watershed zones.

- Routes and watersheds restrict opportunities. There are three key interstate highway corridors at Nashville, and all of them are constrained by rail:
  - **I-40**: there is no through rail line east from Nashville to Knoxville to compete with trucks on the I-40 corridor, and the line west hits the gateway at Memphis;
  - **I-24**: the rail route parallel to I-24 reaches a gateway at St. Louis in about 300 miles;
  - **I-65**: the I-65 route arrives at the Chicago gateway within 475 miles.

The Nashville Area is served in addition by two related short line railways: the Nashville & Eastern, extending from Nashville eastward toward Monterey, and the Nashville & Western, running a briefer distance west to Ashland City. The former property figures prominently in the Basic Freight Rail Connector proposed in the Tennessee Rail System Plan of the state DOT. Using a combination of abandoned, non-operating, operating, and newly constructed track, the State proposes to bridge the gap from Algood on the Nashville & Eastern to Class I lines at Oliver Springs, and thereby complete a through route between Nashville and Knoxville.

The proposed Connector is shown on a TDOT map reproduced in Exhibit 11 on the following page. It is important to recognize that Class I network configurations mean this route does not establish a complete equivalent to the I-40 corridor, though it is a step in that direction. A critical freight function of I-40 is its feed into I-81, a key truck route to large consumer markets.
of the northeast. While CSX with the Connector could operate from Memphis to Knoxville on a path parallel to I-40, its lines from Knoxville turn due north, and away from I-81. NS conversely can parallel I-81 and presumably would reach back from Knoxville to Nashville on the Connector, but would need track rights on rival CSX facilities to extend from Nashville to Memphis. In other words, neither Class I railroad would have a through route combination like I-40 and I-81, and in addition, both systems terminate at the Mississippi River.

Exhibit 11: Proposed Memphis to Knoxville Railroad Connector

The scenario described above is problematic from the standpoint of diverting through trucks to rail. The Tennessee Rail System Plan does not claim that trucks traversing Tennessee on I-40 will divert due to the Connector, but does suggest a modest number of trucks running between Nashville and Knoxville may divert. The Plan points to the NS Memphis route via Alabama as already capable of attracting I-40 through freight. There is validity to this concept, but NS is not especially effective in supporting the strategy due to the watershed issue, and NS concentrates its east-west operations further south at Meridian, MS. This rather complex set of considerations boils down to a single key point: Network ownership and structure are basic barriers to railroad capability of providing alternatives to highway freight transportation at Nashville.

The position of Nashville as a crossroads for CSX as depicted in Exhibit 12, where the north-south orientation of traffic flow is visible. The map also places Nashville rail volumes in the context of national rail traffic network. Nashville is a key hub in the CSX system, routing sixty trains per day through the Nashville Area toward five key cities: Atlanta, Birmingham, Chicago, Louisville, and

Exhibit 12: Nashville Rail Flows
Memphis. Forty of these trains simply pass through; the rest are “hubbred” in a classification yard, with the majority of railcars sent out again on a different train set - much like airline passengers change planes in an air hub. Of the 32 million tons of annual rail volume, 88% travels between other markets and is simply transiting Nashville. Just under 4 million tons is based in the Nashville market, with two-thirds of that inbound traffic. International containers, metals, chemicals, paper, and automotive products (new cars and auto parts) are the primary inbound goods; automotive products are the chief outbound commodity by rail.

Two primary facilities are used in Nashville. The major CSX terminal and classification operation is Radnor Yard, located south of town on I-65 by route 255. Three rail-truck transfer facilities are part of the terminal, handling intermodal containers, new automobiles produced outside of the Nashville Area, and bulk commodities. Daily service is provided to the auto plants at Smyrna and Spring Hill. Kayne Yard is downtown alongside I-40, in the gulch; it is a smaller facility serving industrial customers, and performing truck transloading for bulk goods.

Both yards are convenient to interstate highways and there are no important access restrictions at either one, according to railroad and motor carrier personnel, although trains using Radnor will sometimes block the entrance to the intermodal facility, creating self-imposed delays and congestion. However, utilization of Radnor yard is approximately 98% and the facility is landlocked, leaving no capability for growth. Existing trains also are near capacity, meaning they can accept little incremental traffic before triggering the major fixed expense of new train starts, and it is likely that some of the rail lines touching Nashville are approaching capacity limits as well. The consequence is that opportunities for traffic growth – even normal growth in current rail volume, and apart from any traffic that now moves by highway – are materially restricted, and would require both substantial financial investments and new land solutions.

### Air Freight

The Nashville International Airport covers 4,417 acres and is served by 17 scheduled air carriers. The scheduled passenger carriers provide direct service to 81 different markets and make extensive global connections. Freight facilities are located adjacent to the airport’s passenger terminal. The Nashville Air Cargo Link all-cargo complex is located across the airfield from the passenger facility. These cargo connections help meet the high speed transportation needs of area industries such as Dell, whose business model depends on rapid integration of components to the market. The automotive manufacturers also are occasionally dependent on air cargo to keep their assembly lines moving, and the health care facilities require rapid transport from time to time.

Continued development and improvement of the airport facilities for freight purposes plays an important role in attracting and retaining business of this type. The more “high tech” the industry, the more likely it is to require air transport as part of its operating strategy. While growth in air traffic will not likely reduce the number of trucks on the highway, it is still an integral part of the transportation infrastructure requiring the same careful planning as the rest of the network.
The nation’s two largest integrated air freight carriers are FedEx and UPS. Both carriers maintain air hubs a short distance from Nashville. FedEx has its main air facility in Memphis, a 215 mile drive west on I-40, and UPS has a hub at Louisville, KY, 175 miles north on I-65. The practical result of this proximity to the air hubs is that shipments tendered to either of these companies - nominally considered air freight - in fact is moving by truck out of Nashville. In order to make the cutoff times for their departing flights at these hub facilities, feeder trucks out of Nashville must leave the city during rush hour. The arrival side is a little more flexible as the trucks can travel early in the morning; however, they depart the airport some time after planes have landed, and after Nashville shipments have been separated from others at the hub. The end result of this condition is that I-65 on the north side of the city and I-40 on the west side both have particular importance to these two major entities. The traffic situation and potential congestion on either of these routes can cause serious delays in the movement of their shipments.

**Waterborne Freight**

Nashville lies on the banks of the Cumberland River, 180 miles above the point where the Cumberland and the Tennessee join the Ohio River at Paducah, and continue to the Mississippi at Cairo (Exhibit 13). The waterway is navigable upriver and east to Celina, then downriver into the American heartland and the Gulf. River barges on the Cumberland carry 7 million tons of freight for the Nashville Area. Ninety percent of it comes inbound, making the river responsible for almost 20% of the inbound commodity tonnage supplied from outside to the Nashville Region.

Coal for electric utilities, aggregates for construction and other uses, and petroleum and chemical products for industry constitute more than 95% of the volume received from the river. Traffic can be delivered by truck over 100 miles away from the waterside, but most of it terminates within twenty to thirty miles, and some – like large portions of the coal – is brought to consuming facilities on the water. Aggregates like sand and gravel are the chief form of outbound traffic, and primarily originate at locations adjacent to the riverbank. The accompanying map portrays barge traffic moving on the Cumberland and truck drayage on roads to and from its shores, as well as volume elsewhere in the state for the Tennessee River.

There are three public terminals in Nashville loading and unloading freight for Cumberland barges: at Robertson Avenue (mile post 174 on the river), Amy Lynn Drive (milepost 180), and...
Cowan Street (milepost 190). In addition, there are a variety of private facilities along the river handling proprietary goods. Access from the water is described as adequate, and road routes also are sufficient, in large part because of the multiple interstate highways paralleling, crossing, and radiating from the Cumberland. Steel for automotive plants, for example, is supplied in part by water and trucked south from Nashville; barge lines describe this as a successful operation for demanding clients. Substantial changes in traffic volumes are not anticipated, so current capabilities should remain sufficient.

The inland waterway system is maintained by the U.S. Army Corps of Engineers, including its lock and dam structures. There are two single-chamber locks affecting Nashville river traffic: Hickory Lock and Dam upstream between the city and Gallatin, and Cheatham Lock and Dam downstream. They are characterized as satisfactory facilities, which are normally taken out of service for maintenance two to three weeks every five years, causing river traffic to be suspended. The Corps performs maintenance on these structures at separate times rather than simultaneously, effectively doubling the amount of time the waterway is closed. Barge lines and the industries they serve clearly plan for this, but the effect of closures still is to put some amount of truck traffic on the roads. A single 1,500 ton barge equates to approximately sixty heavily laden trucks, slow moving in traffic and relatively damaging to pavement, so the consequences are not negligible. While the MPO has no authority over the Army (nor do the carriers and industry), it certainly can petition the Corps to consider local interests as well as its own resources, as it schedules maintenance work.

Waterway freight system conditions in short are adequate, and allow the river to continue as a low-cost method of supplying basic and heavy bulk goods to the Nashville Area community and industry. The principle long-term issue, in the view of one waterway participant, is the national issue of sustained support to inland river transportation. Resources and policies affecting it require the active interest of states and congressional delegations. The State of Tennessee, in this view, needs to make itself heard on the importance of the federal responsibility for waterborne transportation. Should the waterway become victim to neglect, the primary goods it supplies to the Nashville Area must continue to move. If they cannot go to the at-capacity rail network, they will add many slow and heavy trucks to the road system, affecting congestion, air quality, and highway maintenance budgets. The role of the MPO, in this respect, is to urge comment by the State and to lend its voice in support.

Identifying Freight Issues in the Nashville Region

Freight Stakeholder Outreach: The process of building stakeholder involvement began with a public forum at a winter meeting of the Middle Tennessee Council of Logistics Management. CLM is an organization whose membership comprises the key players in the area of freight transportation from several perspectives: shippers and receivers, carriers, and warehouse and logistics service providers.

A presentation was made at this meeting to introduce the project to this audience of key individuals. Flyers were available at this meeting to carry back to others, to provide more detail and reminders of the importance of the project to the freight community. The presentation generated initial interest, introductions and momentum for subsequent interviews and field work.
Wide Area Mailing - Following the CLM meeting, a wide-area mailing was completed to 451 companies identified in the Harris data set, or through CLM and other contacts, representing a cross-section of area businesses. This mailing announced the study and contained a relatively brief, top-line fax-back survey. While its response rate was a modest two-and-a-half percent, the survey proved useful in several ways:

- By providing a backdrop of publicity for the pursuit of field research, because all recipients were introduced to the study through the mailing;
- By attracting voluntary candidates for targeted interviews; and,
- By the survey responses themselves.

This mailing built on the momentum from the CLM meeting, soliciting information and support from others in the community. A copy of the survey document and a compendium of responses appear in the Appendix.

As a result of this preparatory work - data analysis, introduction of the project to CLM, and the wide area mailing, the team was able to identify a group of companies and individuals whose input would be beneficial to the Task purpose. Targeted interviews of these stakeholders formed the core of Task 2.

Interviews - The field research had two components: constituent interviews and on-the-ground observation. The study team completed face-to-face and telephone interviews with target companies touching all key sectors of the Nashville Area economy, and covering the commercial geography.

Interview targets included both top industrial employers within and affecting the Nashville Area – such as automotive manufacturers, electronics, and the printing and publishing businesses – and also important service sectors whose goods movement requirements are service sensitive and logistically complex. The health care institutions were prominent in this class. Wholesale distributors and suppliers were sought out who were active in certain sectors of the market, including food and exhibition services. Support services with significant transportation requirements like construction and waste disposal were included in some instances and the full modal range of freight carriers was contacted: rail, air, river barge, and a variety of for-hire and private trucking operations.

While this segment of the work was not intended as a systematic treatment of every freight aspect in the city, it was designed to get at the most important segments of the economy and to outline fairly specific classes of problems and work to be completed.

Interview outlines were designed to be flexible and adaptable to a range of targets. Several organizing principles guided the collection of information:

- Depict supply chains to understand how goods are staged, trip and temporal patterns, and the interrelationships of businesses and facilities.
- Understanding how certain elements of infrastructure play critical roles in the freight network, supplying service to the chief drivers of the local economy.
Collecting as much information as practical to carry forward into subsequent phases of study, to avoid the need for repeated interruptions to busy schedules.

Field Observation - Ground observations were accomplished by study team members driving the highways and streets, entering industrial parks and retail centers, and observing major freight facilities. A period of time was spent making local pickups and deliveries with truck drivers from a major freight provider in the area. The second method of observation was a by-product of face-to-face interviews as a result of traveling to and from business sites, observing the condition of those sites and their serving network first hand.

The interviews and the field observations resulted in the identification of a set of primary issues that are clearly defined and narrow enough to result in sound strategic recommendations, that will stand alone as a result of this project. They are also comprehensive enough to form a reliable foundation for any subsequent work that might be done, either by the MPO or by others with the cooperation of the MPO.

Stakeholder Concerns and Issues: Fieldwork - including interviews, direct observation, and a survey of truck drivers - uncovered a series of limitations to logistics performance in the Nashville Area. Some are specific, like the call for a traffic light at a particular intersection, and others are systematic, offering either an individual example of a larger need, or a general description of such a need. Most relate somehow to the operating circumstances for trucks in service to customers, although there are multimodal dimensions in certain cases. Some will make good Quick Start options – initiatives of modest scope and cost that make improvement in freight conditions, demonstrate responsiveness and commitment to these issues on the part of the MPO, and encourage engagement by the freight community in the public process. Some are important but larger in scope, and others really are general programs the MPO can undertake, or would need to organize and promulgate with additional public agencies. In an appendix is a compilation of specific problem areas; in this section, the systematic issues will be reviewed, and a selection of specifics highlighted.

Aligning Regional Transportation Policies to the Modern Economy

In today’s global marketplace the need to “think globally and act locally,” often is a heavy burden on metropolitan transportation networks. Improving freight mobility in metropolitan transport networks can result in substantial cost savings to regional business and ultimately increase the Region’s economic competitiveness.

Due to Nashville’s central location in the East-Central U.S., it can be expected that freight traffic volumes in the Nashville Area will continue to grow at a brisk pace. According to the Federal Highway Administration (FHWA), international freight tonnages impacting Tennessee are anticipated to nearly triple between 1998 and 2020. At the same time, domestic tonnage traversing Tennessee is expected to grow by 70%. To accommodate this growth without impacting economic development and quality of life, the Region should develop and implement transportation planning policies designed to deal with the externalities associated with increasing

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9 FHWA web site, accessed on 11/18/04:  
http://www.ops.fhwa.dot.gov/freight/freight_analysis/state_info/tennessee/profile_tn.htm
goods movement demands. Establishing public planning policies directed toward freight, can also mitigate undesirable externalities by promoting intermodal connectivity and communication between the public and private sectors.

The Nashville Area’s status as crossroad in the transportation networks of the Eastern U.S. will continue to facilitate growth in the volume of freight transport both internal and external to the Nashville Area. Nearly 60 million tons of freight originate or terminate in the Region annually, with more than 80% of this volume moving by truck. The ability for freight to be transported timely and efficiently is impacted by both mobility on, and accessibility to the regional transportation network. Localized congestion within the Region provides a finite number of sufficient corridors with which to accommodate the increases in population and freight volume. The lack of sufficient mobility leads to transport inefficiencies, which are manifested by way of delayed delivery times and higher costs to both the shipper and, ultimately, consumers.

With the tremendous growth experienced in many metropolitan areas over the past several decades, urban planners are being challenged to incorporate sustainable development methods into their planning process. Sustainability with respect to freight implies the degree to which safety and economic benefits of freight transport are maximized, while at the same time minimizing travel delay and pollution. Sustainability with respect to freight is likely to be best addressed through efforts such as:

- Maximizing the efficiency of regional logistics systems;
- Facilitating freight consolidation and intermodal transfer facilities;
- Promoting safe and efficient infrastructure design; and,
- Urban (corridor) planning and design.

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Too many trucks on state highways

A 10 percent increase in truck traffic in Nashville could on average increase individuals’ travel delays from 44 hours in 2000 to 51 hours by 2010…. Truck traffic is expected to double in the next 20 years and with its central location, Nashville roads cannot be built wide enough to accommodate such an increase...

To tackle the problem, the Tennessee Department of Transportation (TDOT) is looking at a new freight model to address the overrun of trucks on Tennessee’s roadways as part of its long-range, intermodal transportation plan, which the department rolled out this year.

“One of the key features of the [long-range plan] process is going to be a freight model,” TDOT’s Chief of Environment and Planning Ed Cole said. “So [we haven’t done] actual tonnage by type of cargo and then breaking that out by mode, whether it’s truck or rail or pipeline or barge or aerial, that’s a fairly new process.”

About 10-40 percent of interstate volume is truck traffic, with the percentage being higher in rural areas, TDOT transportation manager Steve Allen said.

Looking at specific counts of truck volumes in Davidson County, truck traffic along the I-24 corridor is between 12 and 21 percent of the overall traffic. Along I-40, between 10 and 26 percent of all traffic is caused by trucks, at I-65 the truck volume is between 8 and 18 percent, and on I-440 it is between 11 and 16 percent.

Nashville’s Metropolitan Planning Organization (MPO), which includes the counties surrounding Davidson County, has been working for the past year on a freight study called the Nashville Regional Freight and Goods Movement Study that looks at all modes of transportation. Results will allow better incorporation of freight movement into the local planning process and will be published within the next two months, MPO Transportation Manager Brad Thompson said.

As described in Tech Memo 2, the key industries in the Nashville Area fit a profile of service sensitivity with regard to freight transportation. Mobility along all links of the regional transportation network are essential for optimal function of regional business supply chains. Delays in freight transport carry business and social costs, including:

- Higher probability of inventory and production failures;
- Risks of product degradation;
- Inflated job site expenses;
- Congestion at loading docks or staging areas;
- Lower labor productivity;
- Under utilized capital assets; and,
- Risks to individual business viability.

The efficient flow of freight is critical not only on interstate facilities, but at every stage of the supply chain. Therefore, freight transport policy should be a key component of overall regional transportation efforts. Freight transportation policies should also be addressed in the comprehensive planning efforts of other local and regional agencies such as: economic development agencies, transit agencies, and airports. In doing so, regional economic growth can continue to prosper, and the quality of life that residents of the Nashville Area have come to expect can be assured for future generations.

Strategies to maximize the efficiencies of the inter-relationship between shippers, transport carriers and planners should be a central concern. To move forward a more sustainable freight network in the Nashville Area, the discussion of policy recommendations, and the strategies and projects that follow, have been organized into three focus areas:

- Freight Mobility
- Urban Design and Growth Management
- Economic Vitality and Quality of Life

Developing a Strategic Plan to Address Freight Planning Needs

The purpose of this Technical Memorandum is to outline opportunities for incorporating freight into the planning process of the Nashville Area. The recommendations are intended to provide a framework for the development and implementation of specific policies, strategies and projects that serve to enhance the mobility and productivity of freight transportation in the Region while enhancing safety, efficiency and environmental quality.

Defining Strategic Freight Transportation Goals: Efforts to plan and invest public resources should have well defined, publicly supported goals. As discussed in Tech Memo 2, the Nashville Area MPO has established a good foundation for regional freight planning through the goals stated in the Long Range Transportation Plan:

*Policy Goal 2: Regional Mobility through a Multimodal System: Achieve enhanced mobility by providing an intermodal and multimodal transportation system that supports safe, efficient and convenient travel options for the movement of people and goods.*
Working from this goal, Exhibit 14 proposes a strategic policy framework that will be discussed throughout the remainder of this report.

Exhibit 14: Proposed Strategic Framework for Regional Freight Planning

Policy Goal 2:
Regional Mobility through a Multimodal System

Suggested Policy Objectives
- Enhance freight mobility
- Improve safety, economic vitality & quality of life
- Include freight in urban design & growth management

Potential Strategies for Achieving Policy Objectives
- Land use planning and zoning for freight
- Urban design for trucks
- Develop better freight data
- Partner for freight planning
- Focus on key corridors
- Incorporate trucks in traffic designs
- Use ITS technology
- Design standards for regional freight infrastructure
- Freight impacts on air quality
- Environmental Justice Issues

Public Policy Objectives for Freight Transportation Planning: In reviewing other freight planning activities at the metropolitan level, the following three objectives typically provide the basis of achieving regional freight network goals:

- **Freight Mobility** - A typical objective of freight planning is the enhancement of freight mobility; i.e. improving the efficiency of freight movements in the Region. All policies, strategies or projects implemented in the Region should be evaluated to determine the impacts on freight mobility.

- **Urban Design and Growth Management** - Another objective in support of developing a sound freight network is the need to manage urban design and growth. By employing measures and policies to improve urban design, one can also improve the reliability of the system. Zoning and building codes can be used both in shaping urban design and improving transport efficiency and reliability.

- **Economic Vitality and Quality of Life** - Mobility objectives must be balanced with public safety, overall economic vitality and quality of life. Regional planning activities should be evaluated to determine the impact on the environment, safety and the community (environmental justice). For instance, projects that improve freight mobility by lowering congestion can also effectively lower emissions, thereby improving air quality and quality of life in the Region.
This report discusses specific opportunities that can be leveraged toward reaching the broader objectives of freight planning. The proposed strategies depicted in an outline format are organized as follows:

1. **Planning to Enhance Freight Mobility**
   - Focus on key truck corridors
   - Incorporate trucks in traffic design
   - Enhance freight operation using technology
   - Support freight planning with data
   - Promote intermodal operations
   - Partner for effective freight transportation planning

2. **Urban Design and Growth Management Policy**
   - Land use planning for freight
   - Regional zoning for freight infrastructure
   - Design standards for freight infrastructure
   - Urban development
   - Using the development review process to benefit freight

3. **Policies Promoting Economic Vitality and Quality of Life**
   - Air quality issues
   - Environmental justice

1. **Planning to Enhance Freight Mobility**

The level of mobility and accessibility to the Nashville Area transportation network is a key consideration to the smooth and efficient flow of freight. Within the Region, increasing highway congestion affects the cost and efficiency of truck transport, and subsequently the reliability required for just-in-time delivery. Congestion within the Region is occurring at a time when the need for freight movement, primarily from trucks, is likely to increase significantly. The general evolution from push to pull logistics and subsequent demands for just-in-time delivery, combined with growth in distribution centers, will likely heighten regional business sensitivity to disruptions caused by traffic congestion. Traffic congestion typically results from growing population and subsequent increases in travel demand. Since several factors are contributing to the current trends, addressing traffic congestion requires a balanced approach.

**Focus on Key Truck Corridors**

The Nashville Area has a well developed network of roadways with specific routes playing specific roles in network distribution. From a freight movement standpoint, network roles should become a central part of planning the Region’s transportation system. At a very basic level, there are at least three network roles the regional street and highway system serves in providing for truck traffic:

- Through routes;
- Regional arterial stem routes
- Local connectors to freight activity centers
Three major U.S. interstate highways intersect in Nashville: I-40, I-65, and I-24. The daily patterns reflected in the chart of Exhibit 15 make it clear that the majority of the freight is moving through the Region in the hands of the nation’s many truck lines. The bars reflect the annual number of truck units moving “through” the area, while the line graph represents the average length of haul distribution. The steep slopes of both indicators suggest that the origins of this traffic are well beyond the Metropolitan area. Seventy-three percent of through truck traffic travels over 500 miles, and the average length of haul for this longest-distance segment exceeds 1,000 miles.

Trucks moving through the area are traveling for the most part on the interstate highway system. Exhibit 16 displays these through routes and their associated truck traffic volumes.

Exhibit 16: Through Truck Routes and Associated Annual Truck Traffic Volumes
Continued investment in these key through routes is important in sustaining the Nashville Area freight network. Moreover, investing in routes that function as viable alternatives such as adjacent arterials, as well as the completion of circumferential bypasses (for through traffic), will help sustain these corridors. The volume and proportion of through truck traffic plainly is a significant component of diesel emissions and a contributor to congestion on roads. Strategies that deal with these issues must contend with this traffic.

**Bypasses** - A complete highway bypass system, integrated with growth plans and managed for freight accommodation should be considered a requisite part of the response to through truck traffic. Bypass routes move traffic out of the core of the network that isn’t obliged to be there, due to regional origin-destination points. Such routes also serve to dilute emissions by dissipating them through a larger geographic zone. Bypasses are not a new idea and the Nashville Area employs them – but like other cities, its system is in various stages of completion. Related to bypasses are methods of encouraging their use. Simple steps like route designation and signage can be effective, or traveler information channels can be applied to advertise the advantage of preferred routes to unfamiliar drivers. Some metropolitan areas have posted advisory signs upstream from bypass exits, encouraging through trucks to use them. Freight support services like fueling stations, rest areas and fully equipped truck stops affect routing choices, especially if they are available on the core network and on by-passes. Distance, time, and their cost implications are the principle criteria for motor carrier route selection. Since most bypass routes are likely to be longer, having variable message signs with the time implications of route choices may be one way to encourage their use under heavily congested conditions.

**Tolling** - Toll roads currently are under investigation around the nation as a means of generating partial financing of infrastructure and influencing travel behavior. They are especially but not exclusively directed at commercial traffic, and make particular use of electronic toll collection as a means of reducing delay, muting resistance, and applying charges selectively. Federal flexibility on tolling is becoming greater than in the past, and although policy is not fixed, the option is justified for consideration. The trucking industry is generally opposed to tolls on existing facilities, but has expressed willingness to considering tolls on new capacity expansions.

**Truck Separation** – Although the previous national transportation bills (ISTEA and TEA-21) advocate an increase in multimodal transportation planning and programming, and the next bill is likely to take this even further, it is important to recognize the need for separation of freight and passenger/commuter traffic, where it makes sense. This is especially important in areas of high traffic density and where good alternatives are available. The most fundamental form of separation is to design roadways with sufficient lane widths, providing traffic sufficient maneuverability. Another form of separation is to restrict specific types of traffic along specific corridors.

**Regional Traffic Routes**: Through truck traffic has been described here as a significant piece of the overall volume. However, while it is large, it does not overshadow the need to understand and plan for regional traffic development, which is the segment with most effect on the area economy. The map that follows on the next page in **Exhibit 4.5** shows the non-interstate routes that are used most heavily by truck traffic operating in the Region, according to interviews with carriers and shippers.
Exhibit 17: Key Regional Truck Routes

The pressures of growth, the service sensitivity of key industry, and the tension between commercial development and the provision of transportation argue for a core network of freight-effective radials, rings, and connectors. These are commercial corridors where volume is concentrated, and stem routes, by which trucks travel from terminal areas or distribution districts into delivery pockets. It is not necessary that these facilities acquire exclusive or restricted truck lanes, although separation of passenger and commercial traffic has advantages for both. The strategic purpose of a system of freightways is both developmental and operational:

- Developmentally, the network is protected by zoning, building permits, and enforcement, so it can sustain truck traffic volumes efficiently. Road geometry and lane structure are laid out for large vehicles, with appropriate turning radii, height clearances, and passing points.

- Operationally, the network is managed for freight. Traffic management centers observe the routes, have staff members conversant with trucking requirements, and can reach the logistics community with timely advisories. Signaling is timed for truck movement from known freight generators and receivers. Relief routes are pre-defined, so that incidents can be handled with diversion as well as intervention. Construction activity does not disrupt a route and its relief simultaneously, and construction as far as practical is coordinated with industry, avoiding commercially sensitive time periods (like month-end) and understanding the time patterns of line-haul and city freight schedules.
By recognizing and then designating the network roles of infrastructure, and constituting a core system of freightways, commercial traffic is channeled in natural ways, the resources of the MPO can be devoted to freight where it does the most good, and system performance probably can be raised. Associated with this system and served by it is the purposeful development of freight villages.

Future development plans for routes accessing key intermodal transfer points such as the CSX intermodal yards or the Nashville International Airport, should include specific design features to accommodate truck traffic. Examples exist across the nation where key staging points have exit and entrance ramps exclusive to truck traffic to facilitate unimpeded access to these facilities. It is also anticipated that the next transportation reauthorization bill will contain provisions specifically for improving “intermodal connector” routes. With this in mind, the Nashville Area MPO may wish to consider developing an inventory of such routes and their condition.

Local Routes: Incorporating Trucks in the Traffic Design

Thorough the interviews/survey process shippers and motor carriers in the Nashville Area identified truck turning radii on narrow roads as an issue, but so too did the more difficult operating problem of narrow roads coupled with roadside ditches (open trenches used for water drainage). For a large truck, and especially for a driver unfamiliar with the surroundings, ditches become traps; a solution might be a program to cover the trenches with grates, in heavily traveled freight zones. The same problem of road width is exacerbated in a different form by the encroachment of structures on the right of way. Traffic design issues often contribute to a less reliable freight network. By developing a defined network and understanding the specific freight roles played by the Region’s highways, roadway improvement strategies are likely to be more successful. There are several common areas of need for roadway design standards for truck activities:

- Intersection Design;
- Cross-Section and Geometric Design;
- Signalization; and,
- Separation.

Intersection Design affects accessibility through delayed right turns due to oncoming traffic. To avoid oncoming traffic, trucks maybe forced to “cut corners” onto curbs, while in other instances “curb hopping” may be attributed to lane-dividing medians. In either case, when forced onto curbs or medians while negotiating a right turn, trucks run the risk of load shifts and damage to the goods they carry.

Left hand turning requirements can be accommodated by the use of offset turn lanes where vehicles are held back to a stop line some yards short of an intersection. This creates a wider turning space for commercial vehicles negotiating the corner, and lanes like this were cited by motor carriers as sensible management for narrow road widths, in districts with significant truck
activity. A Quick Start option would commence a general program to deploy such lanes, examining road widths in truck districts and introducing offsets where practical, over some defined period of time.

Intersection impediments, such as telephone poles, signs, or landscaping can also affect maneuverability. Landscaping, when combined with either oncoming traffic or center medians, can place a tremendous burden on truck drivers in terms of maneuverability. Further, natural and artificial impediments, when not placed properly taking into consideration freight transport interests, can affect sight lines. Such an effect can directly impact intersection safety for freight and passenger traffic alike.

**Cross-Section and Geometric Design** — The geometry of a specific roadway, including the turning radii, lane widths, and other cross-sectional factors should be based upon the intended use or role of the facility. Regional truck routes tend to accommodate large, as well as smaller, trucks (WB50 and WB70) and, therefore, should be designed to accommodate those vehicles without creating significant traffic impacts. Local truck routes also need to accommodate larger and smaller truck sizes, and hence would have to be designed accordingly.

**Signalization** — The last several decades have seen significant advancements in signal technology and timing methods. Unfortunately, better timing plans are limited by the availability of good traffic data on a continuing basis. Signal timing optimization is often performed using data collect from only one or two days and typically does not include truck volumes. Several studies have taken place recently to develop better signal plans for heavily traveled truck corridors.

The spacing of traffic signals and the individual timing patterns, while accounting for light-vehicle mobility, in many instances fails to account for the time it takes heavy truck traffic to attain a reasonable speed or to stop. Abrupt starting and stopping by heavy trucks wastes fuel, increases transport costs, and diminishes air quality in the Region. With just-in-time delivery practices, truckers must maintain tight delivery schedules. The less delivery schedules are impeded by inadequate signalization or intersection maneuverability, the greater the ability for truck drivers to make multiple deliveries with one trip.

**Nashville Signal Timing**

During the study, Bob Weithofer and Jonathan Clegon with the Public Works Department at the Metropolitan Government of Nashville and Davidson County indicated that truck counts are taken into account when developing signal plans for high volume truck routes. In addition, intersection clearance times are longer for high speed routes with high truck volumes, typical in some exurban locations. Currently, seven corridors are under study for improved signal timing:

- Nolensville Pike/Harding Place
- Gallatin Pike
- West End Avenue/Harding Road
- Bell Road near Hickory Hollow Mall
- Murfreesboro Pike
- 21st Avenue South/Hillsboro Pike
- Lebanon Pike
Enhance Freight Operations Using Technology

ITS (Intelligent Transportation Systems) technologies have proven to be a relatively low-cost means of improving traffic operations and increasing safety. They often also provide an efficient means of collecting data about traffic. The USDOT has developed a “National ITS Architecture” which is a framework that provides a common reference for planning, defining, and integrating ITS across jurisdictions.

One of the more compelling reasons to follow the National ITS Architecture in planning and deploying ITS is derived from a TEA-21 requirement that any ITS project receiving funds from the highway trust fund “conform” to the National ITS Architecture and applicable standards. The architecture describes functions and processes, defines subsystems and identifies system boundaries. However, the Architecture is NOT a system design, design document, or development process. Nor does the Architecture prescribe specific technologies. Rather, the National ITS Architecture provides a common structure for terminology and nomenclature that is used nationwide by public sector agencies deploying ITS, systems engineers designing ITS and vendors selling ITS products. The National ITS Architecture helps to identify systems and institutional integration opportunities and information exchanges among regional entities. Exhibit 18 below shows some of the stakeholders, systems, and information exchanges relevant to freight transportation in the Nashville Area that are reflected in the National ITS Architecture.

Exhibit 18: ITS Architecture – Examples of System Integration

The National ITS Architecture provides an avenue for consistency of ITS services throughout a given planning or service area; be it a single county, multiple counties making up a region, an
entire state or multiple states working in coordination. Along these lines the National ITS Architecture helps to reduce the tendency towards developing stand alone systems that result in “islands of technology”. With transportation systems becoming more complex and the need for ITS integration increasing, the “islands of technology” of the past are becoming the interconnected, interoperable systems of the future through the use of the National ITS Architecture. Interconnected systems are especially important in the nationwide ITS markets of Commercial Vehicle Operations (CVO) and Advanced Traveler Information Systems (ATIS). The National ITS Architecture and compatible regional architectures provide a valuable tool for project development and specifications in these efforts. Benefits include:

- reduced design costs and deployment times;
- orderly and efficient system expansion;
- better communication between people and systems;
- potential to reduce life-cycle costs;
- lower risk; and;
- standard interfaces.

The following provides a brief overview of ITS systems that are encapsulated as technology bundles in the National ITS Architecture. These systems were chosen for their relevance for improving freight operations and freight related data needs of the Nashville Area.

**Traffic Management Systems:** Increasingly, metropolitan areas are planning and developing freeway and arterial management systems, incident management programs, electronic toll collection services, and related services. The enabling technologies for these services include loop detectors, automatic vehicle classification (AVC) and automatic vehicle identification (AVI) equipment, closed-circuit television cameras (CCTV), and other equipment that can more closely monitor the number, type and identity of trucks and other vehicles passing over the highway system. It is noted however, that metropolitan ITS infrastructure is oriented primarily toward passenger cars and therefore may not address the unique routing restrictions and service demands faced by freight carriers.

**Travel Information Systems** provide real-time information on roadway and traffic conditions. In general, the systems assist drivers in staying clear of congestion spots, such as accidents, which both allows faster incident response and faster clearance of congestion following the response. Systems can also assist in route selection and in publicizing weather-related road conditions. Associated technologies include variable message signs, 511 (a nationwide traveler information number), traffic radio, and web sites, along with sensors, cameras, and data technologies that provide information for the systems.

### ITS to Ease Congestion in Nashville

The Interstate-65 northbound corridor is one of the heaviest traveled interstates in Tennessee. Those who can avoid it do so, but beginning in early 2003, ITS technology to relieve congestion on the route began operating a long a 36-mile segment.

"The 36-miles has speed detection, has camera surveillance, and large, what we call dynamic, message signs over the road," said Don Dahlinger, TDOT.

TDOT is currently testing huge message boards that will inform motorists of work zones, lane closures, or anything that slows traffic.

- Adapted from WKRN Nashville, Feb. 6
Fleet Management Technologies: In the freight sector, carriers such as trucking companies and railroads have been the early leaders in ITS deployment. Freight transporters have a strong interest in investing in new technology to reduce the cost and improve the reliability of long-distance freight transportation; ensure the safety of drivers, vehicles and cargo; and streamline internal business management practices. Fleet and vehicle management systems include onboard computers, routing and dispatching software, mobile communications, and automatic vehicle location (AVL) systems.

ITS technologies provide the addition benefit of producing data streams that are often very useful for transportation planning efforts. For instance, freight carriers using AVL and other vehicle navigation systems typically have access to large amounts of data regarding vehicle travel times between various locations. AVL combines automatic vehicle identification data with technology that graphically depicts the location of a vehicle relative to a map. The data collected by these systems are proprietary, but in aggregated form may enhance public sector planning efforts. Many elements of the technology bundles previously discussed offer access to data that can support metropolitan freight planning. The table in Exhibit 19 summarizes some of the technology applications, data streams and potential uses.

Exhibit 19: Freight Planning Applications for ITS Data\(^a\)

<table>
<thead>
<tr>
<th>Technology</th>
<th>ITS Use</th>
<th>Freight Planning Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Surveillance Technologies (loop detectors, infrared sensors, radar, CCTV)</td>
<td>Collect information regarding the status of the traffic stream (counts, speeds, incidents)</td>
<td>Provides real-time data on truck travel times and speeds at specific points</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provides detail on types of trucks and commodities</td>
</tr>
<tr>
<td>Automatic Vehicle Classification</td>
<td>Vehicle counts and classifications</td>
<td>Inventory the type and volume of trucks using particular roadways</td>
</tr>
<tr>
<td>Dedicated Short-Range Communication (DSRC) - Automatic Vehicle Identification (AVI) - Automatic Equipment Identification (AEI)</td>
<td>Electronic toll collection</td>
<td>Estimate travel time and speeds on certain corridors or around particular sites</td>
</tr>
<tr>
<td></td>
<td>Electronic roadside screening</td>
<td>Estimate travel time reliability</td>
</tr>
<tr>
<td></td>
<td>Traffic Management</td>
<td>Estimate truck and container flows at intermodal facilities</td>
</tr>
<tr>
<td></td>
<td>Border clearance</td>
<td>Suggest broad O-D patterns</td>
</tr>
<tr>
<td></td>
<td>Container identification</td>
<td></td>
</tr>
<tr>
<td>Smart Cards</td>
<td>Terminal gate access</td>
<td>Provide information on travel times and speeds, route selection, and O-D patterns</td>
</tr>
<tr>
<td></td>
<td>Driver licensing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electronic toll collection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electronic fuel purchasing</td>
<td></td>
</tr>
<tr>
<td>Weigh-in-Motion (WIM)</td>
<td>Truck Weights</td>
<td>Determine the weight of trucks using particular roadways</td>
</tr>
<tr>
<td></td>
<td>Electronic roadside screening</td>
<td>Aid in assessing potential pavement damage</td>
</tr>
</tbody>
</table>

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\(^a\) ITS America, 1997.
Support Freight Planning with Data

Data needs for monitoring freight operations and reliability should build upon data needs for traditional passenger/commuter planning and analysis. In addition to trip purpose, freight specific data should include information about reliability (trip time variance) of the system, time sensitivity needs for different trip purposes (commodities/sectors), temporal distribution (time of day), and distance. These variables provide a more accurate interpretation of freight transportation behavior.

All transportation planning efforts should incorporate data collection efforts for planning, including routine, periodic monitoring of transportation system performance. Monitoring activities provide a methodology for the quantifiable identification of system deficiencies, as well as performance driven improvements. At the system level, freight in a truck is traditionally treated no differently than persons in a car. Trucks are routinely translated into passenger car equivalents, however for effective freight planning the major differences between people and freight movements must be taken into account. The typical freight trip (via truck or rail) is significantly different from a passenger vehicle trip in a number of key areas:

- **Distance**: Most passenger trips tend to be local trips, averaging less than 10 miles of driving, generally for commute to work or school, personal business, social, or recreational activities\textsuperscript{11}. Truck trips especially those passing through Nashville are several hundred miles or more.

- **Time Sensitivity**: Although the purpose of passenger trips may vary, the most important characteristics typically are whether the trip is local or long-distance and whether the trip is for business or pleasure. Freight trips, however, may vary in terms of the commodity being carried and stage in the distribution cycle. A truck hauling scrap metal is much less likely to be sensitive to time than a truck, train, or airplane carrying perishable commodities like food, or a truck bringing consumer products to a high profile tourism destination that uses just-in-time inventory management.

- **Linkages**: The typical passenger trip has a finite beginning and ending, and has little interaction with other modes except perhaps for mass transit. In contrast, a truck or railroad trip in most cases is just one link in a broader distribution network that may include trips by rail, truck, cargo ship, and/or air. Many freight movements that appear to the end user as one trip are, in fact, a series of up to six different links.

- **Temporal Distribution**: Data on hourly variations in truck traffic in 11 cities show that 39 percent of weekday truck traffic occurs between the hours of 8 a.m. and noon. Only 21 percent occurs between the hours of 3 p.m. and 7 p.m., which is the peak for passenger travel\textsuperscript{12}. Truck flows in and out of intermodal facilities often peak during midday or night because of rail, ship, and airline schedules. The differences have important implications for counting periods and computing averages for truck data.


In view of these differences, freight planning requires a unique set of data distinct from that used in commuter related planning activities. The data sets and planning applications are summarized in the table of **Exhibit 20** below.

**Exhibit 20: Typical Freight Planning Data**

<table>
<thead>
<tr>
<th>Function</th>
<th>Data Needs</th>
<th>Planning Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestion Management</td>
<td>Truck-hours of travel</td>
<td>Understand impact of congestion on goods movement</td>
</tr>
<tr>
<td></td>
<td>Average speed or travel rate (hours per mile) for trucks</td>
<td>Understand contribution of trucks on urban congestion and air quality problems</td>
</tr>
<tr>
<td></td>
<td>Added truck-hours or truck-hours per mile due to congestion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Truck transport cost (total, or per truck-mile, ton-mile, or dollar value of freight carried)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Added cost due to congestion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transport time reliability</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Types of trucks and commodities caught in congestion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Energy consumption for trucks: total or per truck-mile or ton-mile</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Emissions rates for trucks: total or per truck-mile or ton-mile</td>
<td></td>
</tr>
<tr>
<td>Intermodal Access</td>
<td>Type of Vehicle</td>
<td>Identify landside access improvement needs</td>
</tr>
<tr>
<td></td>
<td>Volumes of trucks entering or exiting an intermodal facility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Congestion - related delays on access roads to intermodal facilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Queuing counts related to the capacity of the facility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accident rates on access roads to the facility</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Travel time contours around the facility (e.g., driving distance within 30 minutes of the facility)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of people living or working within ‘x’ miles of the facility</td>
<td></td>
</tr>
<tr>
<td>Truck Route Designation and Maintenance</td>
<td>Truck traffic volumes</td>
<td>Identify high-volume truck routes and corridors</td>
</tr>
<tr>
<td></td>
<td>Origin - Destination patterns</td>
<td>Assess pavement damage and replacement needs</td>
</tr>
<tr>
<td></td>
<td>Truck size and weight</td>
<td></td>
</tr>
<tr>
<td>Safety Mitigation</td>
<td>Accident rates</td>
<td>Identify safety hazards and develop mitigation strategies</td>
</tr>
<tr>
<td></td>
<td>Rail grade crossings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low-clearance bridges</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Steep grades</td>
<td></td>
</tr>
<tr>
<td>Economic Development</td>
<td>Truck volumes</td>
<td>Assess economic benefits and costs of freight transportation investment projects</td>
</tr>
<tr>
<td></td>
<td>Commodity movements</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Origin - Destination patterns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shipping costs</td>
<td></td>
</tr>
</tbody>
</table>

**Incorporate Trucks into the Nashville Area MPO Model:** Including truck flows in travel demand models is a growing practice among urban areas wanting to improve freight planning capabilities. Incorporating a heavy truck component into the metropolitan travel demand model for Nashville would provide decision support regarding:
Nashville Area Freight and Goods Movement Study

Final Report

- A tool for estimating changes in heavy truck traffic volumes and routing associated with major infrastructure projects and alignments within the metropolitan area.

- A defensible basis for estimating changes in pavement wear and the life cycle of infrastructure on major facilities within the MPO.

- A comprehensive, quantitative and geographical understanding of the internal and external sources of truck traffic produced and attracted in the Nashville Area as well as sources and routing of traffic through the Nashville Area.

Building a Freight Element for the MPO Model: The basis for forecasting truck movements in Nashville would be consistent with the overall MPO model for the Nashville Area. Tonnages generated by socio-economic and land-use data from local state and federal sources, as well as the Nashville Area comprehensive plan would form the basis for estimating the localized generation of truck tonnages produced and attracted in the Nashville Area within the Traffic Analysis Zone (TAZ) system in the existing MPO model. Inter-modal facilities and exceptionally large establishments producing and attracting truck traffic would be designated as special generators (see text box) and added to this system. The highway network in the existing MPO model would be enhanced with an attribute indicating which segments are on routes permissible for heavy truck traffic.

This would require the development of tonnage generation rates and the selection of payload factors to transform socio-economic and land use data from Nashville into truck productions and attractions.

County Level 2-Digit STCC, TRANSEARCH data would be required to estimate through movements, and tonnage flows exchanged between the Nashville Area and external stations. Tonnage flows exchanged between the Nashville Area and external stations would be extracted from TRANSEARCH data as productions and attractions and distributed into the Nashville Area using a traditional Gravity model and incorporated into tonnage tables for tonnages exchanged within the Nashville Area. The gravity model distributing truck tonnages would entail an adjustment of friction factors from the traditional BPR curve to account for the unique distribution of truck movements in the Nashville model.

A separate tonnage table would be extracted directly from TRANSEARCH data for external to external (through) tonnages. These tonnages would be transformed into truck trip tables using payload factors selected from publicly available data sources, and from other metropolitan area

Special Generators: Special Generators are locations within the study area that are expected to generate exceptionally large volumes of freight or truck traffic. In some cases, truck rates from ITE manuals can be used to estimate truck traffic to and from these facilities.

However, for inter-modal facilities and other special generators, portable loop detector technology can provide a way of providing highly accurate measures of freight volume generation. By placing portable loop detectors at the entrance and egress points of especially significant special generators; commodity generation rates, as well as peak hour rates can be developed to ensure accurate capture of freight activity at key locations.
truck models. The truck trip tables would then be incorporated into the equilibrium assignment of the Nashville Area MPO model in a multi-class equilibrium assignment.

Because there are localized truck movements and routes not directly attributable to employment and land use (such as delivery trucks, moving vans and other heavy vehicles) a final step in model development would entail Origin-Destination Matrix Estimation (ODME) of these trips. This would be accomplished by comparing the base-year heavy truck assignment resulting from the model with actual heavy commercial ground counts from the base-year. Centroids in areas expected to be nodes of production or attraction for truck trips not captured by the employment or land-use based tonnage generation methodology would be identified as potential origins and destinations for these trips. The ODME would then be used to estimate the distribution and routing of localized non-employment based truck traffic, resulting in a truck model that replicates base year heavy commercial volumes throughout the study area. This model could be applied with socio-economic forecasts and roadway network scenarios for forecasting and truck traffic analysis at the system level.

Data Requirements: The following data sources would need to be purchased or developed to support basic heavy truck freight modeling in Nashville:

- Designation of truck routes in the current model network
- Identification of special generators for freight
- County Level 2-Digit STCC Reebee TRANSEARCH data for commodity flows into and out of the Nashville Area
- Employment by industry sector (or industry group) for each TAZ in the Nashville Model (base year and forecast)
- Payload factors appropriate for trucks in the Nashville Area
- Heavy Commercial Truck Counts for all truck routes

Applications of a Metropolitan Area Freight Model: A model of the type described above would enable the Nashville Area MPO to perform the following analyses:

- Estimate future truck volumes on major corridors and routes
- Estimate the local and external connections, and relative magnitude of connections made by specific facilities on the roadway network.
- Estimate the free-flow and congested times and minimum time paths for key truck routes and connections based on future development, and how these times and paths might change as a result of proposed land use, economic development or roadway improvement projects.
- Estimate system-wide Vehicle Miles and Vehicle Hours of travel for trucks on the Nashville network; the degree to which these statistics are attributable to congestion effects, and the degree to which these statistics may be responsive to different roadway improvement strategies.

Enhancements to a Metropolitan Area Freight Model: The data used in developing a freight model for the Nashville Area could also be used to develop complementary decision support tools for freight planning in the Nashville Area. One potential enhancement to a local freight model entails the development of a visualization tool (Commodity Information Management...
System; or CIMS) to enable planners to easily visualize and query external traffic into, out of and through the Nashville Area. Another potential enhancement would be the development of a mode-choice element for freight in the local model.

Commodity Information Management System: The Commodity Information Management System (CIMS) is a product developed by WSA to enable clients to easily visualize commodity flows using travel demand model elements. CIMS places the commodity flow data for origins and destinations of major commodity groups into a windows-based user interface that enables the user to easily produce queries and maps to obtain and visualize tonnages, origins and destinations for commodities traveling into, out of and through the study area. The latest version of CIMS has an element that provides reports on the economic impacts of commodity flows as well. The key advantage of CIMS is it gives the user access to information used in the travel demand model to easily generate reports without the need to manually extract information from the model itself.

A CIMS product would enable planners in Nashville to:

- Determine and map the key origins and tonnages of major commodities imported to the Nashville Area by mode.
- Determine and map the key destinations and tonnages of major commodities exported from the Nashville Area by mode.
- Determine the economic impacts of the import or export of a particular commodity to or from Nashville by any given mode (or combination of modes).

Mode Choice: Increasingly Mode Choice is an area of concern in freight and commodity flow modeling and forecasting. Recent research has provided a methodology to split tonnage commodity flow tables into mode-specific tonnage flow tables responsive to changes in the travel time, travel cost, distance and reliability of shipments by competing modes. In the Nashville setting, this type of model would be applied to long-distance freight flows into and out of Nashville from major nodes of highway, rail, air and water networks.

Development of a mode-split component for freight modeling in Nashville would entail estimating the relative base-year shipping times, costs and a measure of reliability for different

A recent CIMS Product for the Roanoke MPO makes it easy to map the exchange of commodity flows between the Roanoke area and external stations.
modes available for shipment into and out of the Nashville Area to and from major origins and destinations of major commodity imports and exports.

A mode choice component in a Nashville freight model would enable planners to determine:

- The degree to which improvement projects in Nashville reducing travel times or costs and access to key freight origins and destinations in other parts of the nation or world would change the expected utilization of different freight modes.

- The overall net increase or decrease in shipping cost or distance by commodity group is likely to occur across modes for an improvement in any given mode (or combination of modes) of freight transportation.

- The expected changes in the distribution and routing of truck volumes that may result from improved efficiencies on other modes.

Finally, in gathering pertinent GIS data for this project, data supplied by individual county planning agencies was inconsistent in terms of format and attributes. A regional approach to geographic information resources offers a good first step in conducting better regional land use/freight planning in the Nashville Area. A consistent means to share geographic data among all users in the Nashville Area could produce significant savings for data collection and usage while enhancing decision making in the area of land use planning. A step the Nashville Area MPO may wish to consider is the development of an “I-Team” under the National Spatial Data Infrastructure initiative sponsored by the Federal Geographic Data Committee.

Promote Rail Intermodal Operations

The consideration of rail alternatives is also a response to through truck traffic. It is acknowledged that rail could capture traffic originating or terminating in the Nashville Area, and initiatives like the Basic Rail Connector\(^{13}\) linking middle with eastern Tennessee should help it do so. However, allowing that intermodal services are the most effective at converting highway traffic, the truck drayage for intermodal operations will remain on the streets, and retard (but not eliminate) the truck VMT and emissions improvements that might otherwise seem possible. This fact, coupled with the sheer volume and distance profile of overhead truck freight, makes that segment the appropriate focus.

\(^{13}\) There is further description of the Basic Rail Connector in the Freight Rail section of this document.
Tech Memo #2 identified a number of important obstacles to the relief of highway by rail in the Nashville Region. Long-term solutions certainly may emerge, but their initiation is largely out of the MPO’s hands. Examples include the following:

- Transcontinental railroad mergers would eliminate the watershed issue and profoundly change the opportunities for through freight conversion, provided capacity and financing are sufficient to support new services. If mergers are announced, the MPO together with TDOT can lend its support in formal public statements, conditioned on a commitment of new services that bring benefit to Tennessee.

- Construction of the Connector puts in place a piece that could lead to an improved through route on an east-west line. Cooperative use of infrastructure by the Class I roads thereafter might open a competitive rail corridor along I-40 and I-81. Cooperation could take place voluntarily (there is precedent for this where capacity is constrained), or as a condition of public financing or merger. The role of the MPO would be to assert its interest in intermodal trains on through lanes if these opportunities arise, and to stipulate inclusion of domestic trailer service.

Nearer term, one alternative is to seek reintroduction of sprint train service on the Atlanta-Nashville-Chicago lane. This could attract through traffic from I-24 and I-65, and Nashville traffic to the north; good connections from Atlanta to Florida could enlarge the market addressed. CSX may not have strong interest in this initiative if it lacks capacity for it. One way to attract its interest might be to explore options for expansion or relocation of Radnor Yard functions, with public financing and expedition of approval processes.

Another intermodal service option for the Region to examine is RoadRailer service. RoadRailer equipment is a hybrid that is both a highway trailer and a railcar at the same time. On the highway, RoadRailer equipment is hauled by a regular highway tractor on the RoadRailer unit's rubber-tired wheels. These same units can be coupled together into a railroad train, without having to be loaded onto flatcars.

As shown in Exhibit 21 on the following page Roadrailer’s conversion to rail mode is accomplished by simply adding railroad bogies (similar to the trucks found under normal railcars) between the trailers. Terminals simply require an area where tracks are set into pavement (as on trolley lines) and simple forklifts for moving the rail bogies around.

RoadRailer equipment comes in various configurations, much the same as standard highway trailers, and can be operated either in dedicated trains or on the backs of other trains. (RoadRailer units do not have the same structural strength as regular railcars, as the tare weight would be too high for highway use. As a result they are not operated in mid-train between other railcars.)
The primary marketing company for the Roadrail technology is Triple Crown Services, a subsidiary of Norfolk Southern. The graphic in Exhibit 21, includes a map of current service areas, which have expanded rapidly in the past few years.

Lastly, alliances with other MPOs are useful to forge. Several of them in Tennessee have challenges similar to Nashville, since through truck freight is a statewide phenomenon, and certain of them face air quality requirements as well. Allied MPOs are not necessarily more effective at bringing about large changes from the private sector, but there are at least three advantages to cooperation: a) a unified voice has more influence with the State, especially in the attraction of financing; b) effective railroad actions take place on a network level, so that terminal construction or line expansion in one city may well have benefits for another, or require that another act in concert; and c) should a strategic opening like a rail merger come about, MPOs will be most persuasive if they have prepared joint positions and developed their stipulations in anticipation.

**Partner for Effective Freight Transport Planning**

*The Nashville Regional Freight Advisory Committee:* Creating a formal freight advisory group has become a more common practice for regional freight planning. A common starting point for freight planning is to understand predominant freight patterns in the study region. The consultant team conducted a series of interviews with key stakeholders throughout the Region including shippers, operators, public officials, economic development officials and modal operators. Based upon these interviews, a list of key advisory committee members was developed. Those parties were then contacted to assess their willingness to serve on the committee. **Exhibit 22** (following page) displays the names for participants who agreed to participate in Nashville’s Freight Advisory Committee.

It is important to note that participation in freight advisory meetings might not be limited to these individuals. The initial group could represent a core of primary freight stakeholders whose involvement is crucial to understanding the freight needs of the community. As the group advances, additional stakeholders should be considered.
It is the experience of the consultant team that the charter members will encourage the involvement of business associates and other freight stakeholders.

Additional stakeholders for consideration include:

- Nashville Area Chamber of Commerce
- Dollar General Stores
- Averitt Express
- U.S. Postal Service
- Ingram Publishers
- Bridgestone/Firestone
- Falcon Transport Co.
- Dell Computer

The inclusion and successful implementation of freight-specific policies within the overall Nashville Area comprehensive planning efforts can improve freight mobility, and help maintain the Region’s competitive edge. Such policies are strengthened by facilitating a dialogue between public entities charged with policy development and the freight transport interests, who through their daily interaction with the transportation network can provide valuable insights about needs.

Freight carriers in metropolitan areas have a strong interest in the efficient operation of the trucking and railroad interface to the transportation system. Indeed, through TEA-21, they have been given a federally mandated place at the transportation planning table. There are many other avenues where coordination can take place between the public and private sectors to create a more sustainable environment for metropolitan freight movement. Perhaps no other area of transportation planning offers the number of opportunities for private sector considerations during the transportation planning process than urban freight and goods movement planning.

**Incentives for Businesses Addressing Sustainable Delivery Goals** – Some metropolitan areas offer tax incentives to delivery services employing natural gas or other fuel-efficient delivery vehicles. Similarly, parcel delivery firms which employ fleet management technologies that reduce road miles or travel times could receive positive recognition by the regional community. Firms that deliver in off-peak hours, or that offer other positive sustainable delivery initiatives should be encouraged, publicized, and saluted by community planners.
Driver Education: The issue of safety is paramount in the public’s mind regarding any aspect of transportation system operation. This fact should not be lost on public officials, who can encourage teaching the special considerations that passenger car drivers must employ when driving in truck-intensive traffic. In metropolitan areas with heavy truck traffic, young drivers should be alerted to safety buffer zones around trucks. Drivers, as well as other representatives from the trucking industry, can demonstrate collision avoidance and defensive driving techniques to be employed when in close proximity of heavy trucks.

Delivery Consolidation: Residential express package delivery services do not typically make deliveries unless someone is home to receive the package. This often results in drivers having to backtrack several times a day to attempt a delivery, increasing VMTs and decreasing regional air quality. One strategy to minimize deliveries in residential areas is to encourage businesses to allow or promote express package delivery to the workplace. Another approach utilizes the installation of secure delivery boxes at a central neighborhood location or in apartment buildings so that parcel delivery firms can leave personal packages with “one-stop” delivery.

A good example of a freight advisory group in the North East is the Delaware Valley Goods Movement (DVGM) Task Force, a committee formed under the Delaware Valley Regional Planning Commission, the MPO of the Philadelphia Area. Its stated purpose is to:

“Maximize the Delaware Valley’s position in the global economy by promoting local freight operations and implementing a regional goods movement strategy.”

Membership is open to all freight interests such as shippers and receivers, Class I and short line railroads, port operators and agencies, trucking firms and associations, air cargo carriers, third party logistics companies, industrial development organizations, state departments of transportation, and federal and county agencies.

The Freight Forward program is an initiative instituted by the various transportation agencies in the Delaware Valley to benefit freight carriers and shippers in the Region. Freight Forward was created in recognition of the fact that maintenance and minor improvements to highways, bridges and railroads can be very helpful in making freight operations more efficient and safer. Examples of projects that can be advanced under the Freight Forward program are:

- Pothole repair;
- Resurfacing of highways and railroad grade crossings;
- Installation of directional signage;
- Increasing turning radii;
- Retiming traffic signals; and,
- Improving a railroad siding.
2. Urban Design and Growth Management Policy

While highways, railways, and air travel all play a key role in moving freight to, from and through the Nashville Area, local flow of goods and services is dominated by the trucking sector. This flow supports retail distribution, manufacturing and warehouse distribution, construction activities, waste disposal services, and the pick-up and delivery of courier packages and shipments.

The design of the Region’s neighborhoods, streets, buildings and shopping centers, as well as the location of manufacturing and industrial sectors within the Region, must allow for safe and efficient interaction between the movement of people, freight, goods and services. By carefully considering and integrating freight transport into regional growth planning, the Nashville Area can enhance its ability to influence the Region’s urban form, and ultimately ensure both a high quality of life and a logistics competitive edge for the Region.

Land-Use Planning for Freight

Industrial location patterns are critical to freight transport demand and general freight transportation systems. Successful planning and zoning efforts should strike a balance between competing land-uses while accommodating freight transportation. When structured appropriately, such strategies can help reduce or prevent freight-driven sprawl on the outer fringe of the Region by developing freight and trade-related distribution facilities within existing transportation corridors and zones.

Urban designs frequently encroach on industrial locations resulting in reduced accessibility to terminal facilities and reduced efficiency of freight networks. Local Nashville planning jurisdictions could actively work to guide warehouse and distribution center development to appropriate locations for sustainable freight movement by taking into account modal accessibility needs and adjacent land uses. For freight system users and operators, access to transportation and freight facilities (e.g., warehouses, distribution centers, intermodal yards, air cargo ramps, and other facilities) is very important, and will frequently dictate where and how they locate. Freight system users frequently locate where transportation corridors converge.

To properly plan for a regional freight network, it is necessary that proposed planning activities be officially recognized and implemented at a regional level. Planning procedures that differ across jurisdictional boundaries work against each other, diminishing the efficiencies gained through “just-in-time” inventory management. Without region-wide adoption of transportation planning activities and standards, the value of identifying a regional freight network may be lost. For example, major urban freight corridors often span multiple municipalities and/or counties. The benefits gained from coordinating traffic signal systems along these corridors include reduced travel delay and fuel consumption – benefits that can translate into savings for freight transporters. These benefits are lost if neighboring jurisdictions do not coordinate traffic signals throughout a corridor.

Regional Zoning for Freight Infrastructure:

The creation, by all jurisdictions in the Nashville Area, of a zoning classification specifically designed to accommodate freight staging and distribution facilities would greatly enhance the
ability of the Nashville Area to coordinate, plan for, and attract freight-related development. The following benefits would be realized from the creation of a specialized zoning classification:

- Continued development of freight-intensive clusters and trade-related distribution facilities within existing freight-oriented transportation corridors and zones.
- Opportunities for increased efficiencies by consolidating/clustering distribution centers near existing intermodal facilities.
- Zoning and development review processes ensure efficiency is not compromised by land use decisions that hinder freight operations.

As discussed in Tech Memo #3, the Metropolitan Planning Commission of Nashville and Davidson County has developed land use policy categories and guidance for how policies should be applied. The purpose of the policy guidance is to assist the “development of community (sub-area) plans and to provide direction for implementation tools such as zoning.” The policy guidance has “Special District” categories that are to be applied to areas that are of narrow or specialized in function. The policy guidance has two categories applicable to freight intensive land use: “Industrial and Distribution” and “Major Transportation.”

**Industrial and Distribution (IND)** is a policy category designed to provide for existing and future areas of industrial and distribution development. Most types of industrial and distribution uses are found in this policy category including: storage, business centers, wholesale centers and manufacturing. Certain support uses such as sales, service, and office facilities will also be present in IND areas. Key expectations for IND area development include:

- Good accessibility is essential for IND areas due to the high volumes of overall traffic generated by those uses and/or the high volumes of truck traffic they may generate.
- IND areas may emerge as a collection of unrelated developments or as a single industrial park. Because industrial parks make more efficient use of scarce industrial sites, their development is preferred in IND areas, although it is expected that individual uses will likely develop within the industrial park.

**Major Transportation (MT)** is a policy category designed to accommodate planned and existing major transportation facilities and their surrounding areas. Airports, rail switch yards, ports, and other uses of this type are considered major transportation facilities. MT areas also contain uses related to the primary transportation facilities, such as warehousing and distribution activities. Key expectations for MT area development include:

- Good accessibility is of particular importance to MT areas due to the high volumes of overall traffic generated by uses in these areas and/or the high volumes of large truck traffic they may generate.
- Special consideration should be given to the impacts of airports on surrounding neighborhoods and other noise-sensitive uses. Sub-area plans should be designed to mitigate the effects of airport noise by establishing less noise-sensitive policy under the flight paths, where practical.

**Freight Villages:** The freight village conceptually is a class of industrial park designed and built for productive logistics, with multimodal service, information systems support, goods staging.
and consolidation functions, and attractive industrial or distribution space. More broadly, it is a commercial zone where freight-intensive businesses have clustered or are encouraged to cluster, and that can be supported and managed for logistical efficiency.

At least as important, freight villages are locations that industrial development is targeted, not only as suited to freight-dependent businesses, but as so suited in preference to other areas. Towns may market their advantages and allow development to follow where it will; the clustering of functions like distribution centers may then come about on its own, as it has in areas around La Vergne and Lebanon.

During the course of the study investigation, an area on the Western edge of Nashville was brought to the attention of the consulting team as a potential location for a freight village. Hailey’s Harbor River Terminal on the Cumberland River is situated near the convergence of Briley Parkway and the Nashville and Western Railroad (NWRR), Exhibit 23.\textsuperscript{14}

Formerly the Tennessee Central Railway, the rail line had been abandoned in the late 1960’s. After a failed attempt to revive the line in the 1990’s, the currently NWRR was purchased by the owners of the Nashville and Eastern Railroad in 2001. Since that time the new ownership has used state and federal rail rehabilitation programs to upgrade track and bridges. Currently the NWRR serves 11 customers, hauling scrap/recycling, concrete, steel, chemicals and a variety of other products. The current line operates between Hailey’s Harbor and the Cheatham County Industrial Park located in Ashland City. Future plans for the rail line include eventual track upgrade to allow 286,000 pound railcars.

The site which is currently zoned for light industrial use sits across the Cumberland River from the John C. Tune Airport.

Volume concentration in freight usually builds service economies, whereby transportation costs and time performance are both improved. Dense

\textsuperscript{14} Sources: Phone discussions with Ross Kauffman and Jeff Wilson of NWRR, and TDOT Rail Plan. Web pages at MapQuest.com and TerraServer.com
pockets of business establishments speed pickup and delivery operations, reduce empty repositioning, and help construct stem or linehaul movements with high levels of utilization. Commercial concentration also eases the management burden on public transportation officials trying to raise freight performance. Villages become the points where:

- Building codes and zoning are stressed for adequate accommodation of freight vehicles, including dock space and staging aprons;
- Freightways are specifically designed and managed to reach inside the village with fast access;
- Local streets are kept free of obstruction and encroachment, and parking or waiting areas are sufficient and held clear;
- Off-peak operations may be developed in ways that address their startup inefficiency for pickup and delivery, by attempting to coordinate shipping hours between businesses in the same zone;
- Transportation information like traffic advisories, construction activity, and route alternatives is readily available.

The Association of State Highway Transportation Officials (AASHTO) has identified, the linkage between land use and transportation support decisions must become closer, in order for transportation performance to be efficient, competitive, and sustainable. Freight zones and designed villages become points where infrastructure investment and management resources are devoted to produce such performance, and where the zone characteristics themselves contribute to the result. This cannot happen equally well everywhere, and the capability of the MPO to foster productive logistics is diluted if it cannot be focused. Finally, freightways and freight village initiatives can be undertaken independently, but they are mutually supportive and more effective if done together.

‘WL’ Zoning Classifications and Freight Villages – There are many benefits to defining a specific zoning classification for freight village types of development. Often the zoning designation of "warehousing and logistics" (WL) is used. This designation, supported by the comprehensive plan, can be used to cluster warehouse activities around specific areas that make operational sense. Such clustering can also provide the basis for the development of a "freight village". The model definition of a freight village is where:

- All modes are represented;
- Land prices are not as high as general commercial properties;
- Adequate land is developable;
- Facilities are accessible by local arterials for local distribution;
- Facilities have good access to interstate routes and freeways for regional and national distribution;
- Accessible to rail facilities, directly tied to a Class I railroad main line;
- Accessible to an airport (with frequent service to domestic and international cities); and,
- Accessible to a port offering a wide variety of materials handling options.

A critical function of the zoning is to prevent encroachment on the WL area. WL areas tend to start out in low cost areas that are generally undeveloped. However, these areas are eventually
encroached upon because they offer low cost real estate along main arterials, and are accessible. Once encroachment occurs, land values escalate and traffic conditions deteriorate, making it too costly for WL-type operations and hence forcing relocation. Migration of WL activities presents a problem from a planning standpoint, and it becomes costly to reinvest in the kind of infrastructure suited for heavy duty vehicles. Zoning tools can help prevent encroachment on WL areas, reducing migration.

**Design Standards for Freight Infrastructure**

Officially recognized infrastructure and operational design guidelines implemented by all jurisdictional bodies within the Region are a fundamental element of effective metropolitan freight and goods movement planning.

*Design Guidelines for Roadway Elements* - Truck traffic, particularly heavy-truck traffic, causes a disproportionate amount of roadway wear in comparison to passenger vehicle traffic. Nashville Area roadways designated on the network of freight transport corridors should be designed to common physical standards more durable than conventional roadways. For example, freight network roadways should be designed to higher lane and curb lane widths, as well as shoulder widths. Pavement Condition Rating (PCR) values, as well as intersection radii should also be designed for a significantly higher volume of freight traffic than other facilities.

The City of Portland, OR has developed guidelines for constructing proper turning radii at intersections along truck corridors and within freight staging areas. Portland has developed classifications of truck routes, differing according to the volume and type of truck travel. For each category, Portland has specified a design vehicle\(^{15}\) to be used in construction design.

- **Truck Districts** are intended to provide for convenient truck movement in areas serving large numbers of truck trip ends. A WB-50 design vehicle is to be used for all street classifications in a truck district. However, where land uses create a relatively high number of large truck trips, a WB-60 design vehicle may be warranted.
- **Regional Truck Routes** are typically higher-classed streets and state highways. A WB-50 design vehicle is to be used for design purposes on these facilities.
- **Major and Minor Truck Routes** are to use a WB-40 design vehicle for design purposes. These design vehicles are used in planning intersections and driveways with adequate corner and/or curb radii to accommodate the maneuvering characteristics of trucks that are typical to each category.
- Portland also has developed guidelines that specify minimum curb return distances for driveway entrances that experience high volumes of truck traffic.

\(^{15}\) For purposes of geometric design, the American Association of State Highway and Transportation Officials (AASHTO) has established a set of ten “design vehicles” with standard physical dimensions. These base vehicles are used to determine a variety of geometric roadway features, the most important of which is *minimum turning radius*. There are three design vehicles that specify characteristics of different kinds of trucks. A WB-40 design vehicle specifies a truck with a 40’ wheelbase. Similarly, WB-50 and WB-60 design vehicles specify trucks with 50’ and 60’ wheelbases, respectively.
The Southern California Association of Governments (SCAG) has incorporated the following freight-related design strategies into its year 2000 transportation plan, which emphasizes the importance of goods movement:

- Improve road geometrics in areas used by trucks, to permit large-radius vehicles to maneuver safely;
- Develop standards for road construction that will be less susceptible to damage by heavy vehicles; and,
- Replace inadequately low overpasses and provide sufficient horizontal clearance for truck maneuvers.

**Signalization Guidelines:** Special traffic signalization considerations should be made along freight network facilities. Signal timing plans along freight corridors should be adjusted to account for the larger size and slower acceleration of trucks. As metropolitan truck corridors often span multiple jurisdictions across a region, it is essential that there exist inter-jurisdictional cooperation with respect to coordination of signal timing so that the maximum benefit of this strategy may be realized.

**Signage:** Sign guidelines for design and placement can facilitate the efficient movement of goods, especially for drivers not familiar with the metropolitan area. This applies to roadway identification signs, as well as directional signs along a roadway. Metropolitan areas generally do not specify guidelines regarding the placement of address signs. Consequently, many businesses and residences either lack address signs altogether, or place signs in locations that are difficult to see from the street, making it difficult for unfamiliar delivery drivers to locate individual stops. This can result in delivery trucks often having to stop several times to find the right location, which adds to congestion problems, VMT, fuel consumption and air pollution.

**Urban Development**

Central business districts and corridors with high commercial activity tend to experience significant parking challenges, especially for trucks. This includes on-street parking (curbside) as well as off-street parking (on commercial properties). The inability to find parking near the delivery point slows down delivery for multiple-stop routes, the penalty being higher cost and diminished service (delivery services only serve areas that are viable from an economic standpoint). The decline in service ultimately impacts downtown business vitality. Our interviews indicated that downtown Nashville, in particular, is experiencing such problems.

**On Street Parking and Curbside Management** – Based on our interviews with operators of local truck fleets, most curbside parking, even for commercial purposes, is designed for smaller vehicles such as pickup trucks, vans, and single unit trucks. These spaces are not adequate for tractor-trailer combinations which are growing in use (the usage of twin trailers for downtown delivery is also increasing). Curbside Management can be enhanced using a variety of methods, including provision of larger curbside parking spaces, increased frequency of commercial curbside spaces, designation of commercial curb parking during peak periods, and peak hour pricing mechanisms to regulate parking behavior.
Off-Street Parking – The other area of concern is the adequacy of parking on properties that attract significant truck traffic. This includes commercial retail strips, shopping malls, hotels and recreational areas, convention centers, office parks, and warehouse and distribution areas. Given the fact that warehouse/distribution areas are typically designed with truck traffic in mind, it is the areas that are more retail and commercial oriented that provide the biggest challenge in terms of onsite parking management.

One strategy is the use of building codes to specify truck bays and docks for loading purposes. The construction of truck bays and docks adds to the cost of constructing facilities, and unless the facility is built for a specific truck purpose, there is a tendency to cut these costs. In other words, office buildings, shopping malls and other retail centers which are not principally truck centers, but do attract truck traffic as a consequence of their business, typically do not invest in sufficient truck bays. Building codes where truck traffic is generated should specify the criteria for the number of bays required based on square foot of floor space. These criteria should vary based on the use: office space, retail strip malls, and shopping malls should have different metrics. It is important to note that the criteria for these facilities are considerably less intensive than warehouse and distribution facilities - in other words, building codes for WL facilities are not applicable to commercial areas.

Using the Development Review Process to Benefit Freight

Most new developments in urban areas, such as shopping centers, distribution centers, and office centers, are subject to a development review process. Typically, the review is conducted by the local planning jurisdiction, at the county level. The review board typically looks at the impacts that a proposed project or development will have on land use, traffic, accessibility and other factors. As part of the review process, the developer or project sponsor conducts, among other things, a traffic impact study and outlines a site access plan. This development review process also presents an opportunity to understand the traffic patterns, specifically freight goods and services patterns to and from said developments. Understanding the travel flow patterns for heavy-duty vehicles allows transportation planners to approach planning from a systems and corridors approach. Thus, it is recommended that developers or project sponsors be required to also provide an overall concept plan or schematic that identifies the key routes that are expected to be utilized.

Critical to this process is the identification of local routes (typically under-designed for heavy vehicles) that are intended to be truck routes between key freight generation and attraction points. The process should identify the key linkages between the proposed development and:

- Warehouse / distribution centers that will supply the development;
- Intermodal (airport, rail) centers;
- Major highway corridors; and,
- Other linkages.

The purpose of the process is to answer the following question: What are the local routes of preference for drivers of heavy-duty vehicles that will access the proposed development? Planners can use this information as part of the corridor planning process. On a longer time-
frame, once a substantial amount of data has been collected this way, planners will be able to identify the key routes for heavy duty vehicles, and to implement the appropriate operational and design standards.

It is cautioned that this process should not be viewed as a regulatory tool, but rather as an intelligence gathering tool. In other words, this should not be viewed as a way to limit heavy-duty traffic to a few routes. This would be detrimental to operations, unless the proposed routing plan will improve operations by directing heavy-duty vehicles to adequately designed corridors with sufficient operational advantages.

3. Policies Promoting Economic Vitality and Quality of Life

Air Quality Issues

The transport of freight, goods and services is affected not only by policies related to urban and transportation system design, but by policies related to environmental pollution. Two areas of focus in this regard are noise pollution and air quality. Complaints about noise from railroads and heavy truck traffic are common in residential areas. Policy development which specifically addresses freight mobility, by establishing truck corridors or designated truck routes, optimizing the location of industrial and warehousing facilities, or perhaps addressing operational constraints, can reduce the strain on the existing transportation infrastructure within the Region, and reduce heavy truck routing through residential neighborhoods.

Both state environmental agencies and the Federal government are afforded further authority to implement additional regional measures to achieve attainment, which in some cases involve more stringent emissions requirements placed on heavy trucks and other vehicles. Not only will such potential decisions impact the bottom-line to shippers, but likewise the cost to manufactures and industries will be apparent. In either case, the Region’s economic growth may be stalled as a result.

Pollutants emitted by trucks and automobiles, especially in areas of heavy congestion, impact a region’s ability to maintain attainment of air quality standards. The Environmental Protection Agency (EPA) sets national standards for pollutants such as volatile organic compounds (VOCs) and nitrogen oxides (NOx), which are precursors of ozone formation. EPA designates areas that exceed the set pollutant levels as “non-attainment.” In the Middle Tennessee Region, a little less than half of ozone-causing pollutants stem from stationary sources such as factories and power plants. However, a roughly equal amount comes from mobile sources such as automobiles and heavy trucks.

One function of the Nashville Area MPO’s Long Range Transportation Plan is to estimate the amount of NOx and VOCs resulting from forecasted traffic on the Region’s transportation network. The output from the computerized travel demand model is an estimate of vehicle miles traveled (VMT) and vehicle speeds. Using a factor of grams per mile, the VMT estimate can be converted to estimated emissions at a future target year.

Despite the fact that total VMT in the Nashville Region is forecasted to increase by more than 30% between 2002 and 2025, emissions of both VOC and NOx are expected to decrease by more
than 30%. Anticipated improvements in vehicle technology, scheduled future federal requirements for low-sulfur gasoline and the gradual replacement of older vehicles, will offset much of the increases from higher VMT.

A concern of the trucking industry is that while emission regulations require manufacturers to produce compliant products, they do not require carriers to buy those products. Uncertainty and the likelihood that compliant trucks will cost more, has raised concerns about the orderly acquisition of 2007 clean diesel technology. The possibility of a ‘pre-buy’ of 2005-2006 technology and a very low rate of new truck purchases in 2007 is real.”

Currently in Nashville all conformity analyses and determinations regarding air quality are performed for the Long Range Transportation Plan. A common misconception exists that the conformity is solely performed as part of the Transportation Improvement Program (TIP).

The same conformity determination applies to the TIP because all TIP projects come from the Long Range Transportation Plan. The Plan should contain all elements required by the Metropolitan Planning Regulations (23 Code of Federal Regulations Part 450). These include but are not limited to a 20- year forecast period and fiscal constraint.

One suggested addition for future air quality related planning efforts in the Nashville Region is the collection and tracking of commercial vehicle registration data in the metropolitan counties. Registration data would provide information about the age of the local delivery fleet in the urban core.

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10 Conversation with Robert Clarke, President of the Truck Manufacturers Association
Environmental Justice

A key focus of freight planning policy issues and considerations involve the co-location of similar freight-related land uses. Historically, where land is most inexpensive has tended to be in areas of low-income and minority populations. Recognizing this pattern over time, President Clinton issued an Executive Order (#12898), based on the Civil Rights Act of 1964. The Executive Order directs Federal agencies to develop policies to avoid, minimize or mitigate impacts on low income or minority communities and to better engage these communities in the decision making process.

It is imperative that environmental justice play a key role in the dialogue between public and private entities within the Nashville Area, and that it play a further role in freight-specific transportation and land-use policies within the Region. While on the surface a conflict may exist when proposing a policy of clustering freight-related land uses, through proper dialogue and thorough analysis such conflicts can often be eliminated.

Freight Project Programming and Funding

Previous strategies have focused on influencing the way development actually occurs (using zoning codes, design standards, corridors, designations, etc.) to shape urban development. This strategy area focuses on the process used to actually identify and program specific projects. The process for programming projects is a complex and time consuming effort.

It is important to consider that the types of projects developed for improved freight mobility are typically operational in nature. That is, they do not add vehicle capacity to the transportation system. Such projects do not raise problems of air quality conformity, and are very cost-effective to implement compared to other capital improvements. Some projects, however, can be implemented as a result of partnering between the public and private sectors that could encourage “modal shifts” of freight delivery from one mode (example, trucks) to another (example, railroad) or vice versa. These unique projects could add vehicle capacity to one mode by shifting the freight carriage to an alternative mode.

Project Programming: Once needs have been identified through the system monitoring process, it is necessary to specify projects that address them. Projects that can benefit the Nashville Area freight network are likely to fall into one of three categories:

- Projects to mitigate physical or operational deficiencies;
- Projects to improve system monitoring capabilities; or,
- Projects to encourage or discourage modal shifts between freight modes.

Design specifications and cost estimates of freight related projects should be made based on the recognized design standards developed as part of the metropolitan freight planning process. Once preliminary project specifications and cost estimates have been developed, potential projects can then be forwarded on through the established metropolitan planning process or on to other outside “fast track” planning processes that may be available at the state or federal levels.
In keeping with the concept of corridor-based planning for freight and goods movement, projects should be “packaged” in a corridor-wise fashion as they are developed throughout the programming process, not scattered piecemeal around the Region. Developing and submitting projects focused on freight-intensive corridors will maximize the overall efficiency benefit realized from the implementation of projects that enhance freight mobility.

For projects within the Nashville Area MPO Boundary, project programming is coordinated and managed in partnership with MPO Staff, the Technical Coordinating Committee (TCC), and TDOT with the ultimate decision resting in the hands of the MPO Executive Board. In essence, the process begins with the development of an unconstrained needs plan (vision plan). This vision plan includes projects that have been identified by member organizations and agencies. These projects are typically identified as important to transportation in the Region.

Typically, the vision plan exceeds the funding immediately available to implement the projects, although the long range plan is financially constrained to the projected revenues over the study’s time horizon (20+ years). Therefore, the partner agencies mentioned above narrow down a financially constrained plan by identifying projects of priority and staging them over time, with the highest priority projects finding their way to the top of the list (those with special funding sources also make it to the top of the list). The financially constrained plan provides the basis for developing a three year Transportation Improvement Plan (TIP). Essentially, these are projects that are programmed for development over the subsequent three (3) years. This TIP is re-evaluated on a regular basis to re-determine priorities. As projects are completed from year to year, the projects that fit into the fourth year of the financially constrained plan become the candidates for the 3-year TIP. As with the long range plan the MPO Executive Board must approve the final TIP before federal funding can be used.

This explanation of the process is simpler than the actual process, which requires a great deal of analysis and coordination between member jurisdictions. Moreover, historically, the TIP process has focused on passenger/commuter transportation needs. The reason for this is simply the lack of additional funding for freight specific projects. Given that needs for passenger/commuter transportation already exceed available sources of funding, it is difficult for the MPO (and the State DOT) to include additional needs such as freight-only projects.

However, the bulk of local freight distribution is actually on the local roadway system, which is shared with passenger/commuter traffic. This study has identified a list of freight specific projects, most of which are on the local roadway system. Efforts to identify freight specific projects, using methods similar to those used in this study, often result in projects that would improve both passenger and freight transportation and reliability. As a result, it is likely to be less challenging to incorporate the freight projects into the project programming process, since these projects improve overall system reliability and not only freight reliability.

In the private sector, businesses often approach customer service needs through the creation of “customer service bundles.” Applying this approach to public transportation planning can also help identify short and long term priorities. **Exhibit 24,** on the following page, presents a freight transportation services matrix with examples of how public agencies might approach both “quick response” and long term transportation needs.
The transportation services framework is provided as a means of thinking about “what” types of responses local and regional governments can foster to improve freight transportation in the Region. While the matrix format of the diagram places project examples in distinct quadrants, in most cases many projects will likely fall on a continuum between quick response, low cost remedies and major project investments. Later in this section of the report we will also examine “how” local and regional agencies might pursue transportation improvements through an ongoing dialogue with the transportation community.

Exhibit 24: Public Sector Freight Transportation Services Framework

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<thead>
<tr>
<th>Long Range Planning</th>
<th>Regional Economic Development Value</th>
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<tbody>
<tr>
<td>Distinct</td>
<td>Quick Response Projects</td>
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<td>Provide modest</td>
<td>Low</td>
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<td>operational</td>
<td>High</td>
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<td>improvements and</td>
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<td>leverage existing</td>
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<td>capacity, e.g.:</td>
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<td>- facility access</td>
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<td>- truck staging</td>
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<td>- trans/industrial</td>
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<td>Parks</td>
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<td>- truck only highways</td>
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<td>Seek low cost</td>
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<td>improvements, e.g.:</td>
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<td>- bottleneck removal</td>
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<td>- policy shifts</td>
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Federal Programs that Support Freight Improvements

Federal programs play a key role in financing freight infrastructure improvements. If not for federal entitlement programs, state funding priorities might be quite different should federal “matching” programs providing upwards of 90 cents on the dollar for focused transportation program purposes not be available to the states. Several specific federally supported programs provide for flexibility and/or direct funding on a matching basis with state or local funds to benefit freight. The major federal program areas are included in the “Transportation Equity Act for the 21st Century: Moving Americans into the 21st Century” (TEA-21):

*Congestion Mitigation and Air Quality Improvement Program (CMAQ):* The federally funded CMAQ Program directs funds to transportation programs and projects which will, or are likely to
contribute to attainment of National Ambient Air Quality Standards (NAAQS). Funds may be allocated by the USDOT and obligated by the states where:

1) The U.S. Secretary of Transportation, after consultation with the Administrator of the Environmental Protection Agency, determines that a project or program requested by the state is likely to contribute to the attainment of a national ambient air quality standard, whether through reductions in vehicle miles traveled, fuel consumption, or through other factors, or

2) Where a project or program is included as a mandatory transportation control measure (TCM) in a State Implementation Plan that has been approved by the Environmental Protection Agency, pursuant to the Clean Air Act, and the project will have air quality benefits.

Projects and programs may be funded if, after consultation with EPA, FHWA determines they are likely to contribute to attainment of a NAAQS. CMAQ funding may also be used for preliminary engineering (including environmental or NEPA documents) associated with projects or programs that have air quality benefits, and related project development benefits (e.g. – freight and commercial transportation projects). TEA 21 amended Title 23 U.S.C., Section 149 to allow use of CMAQ funds for “public-private” partnerships to promote fleet conversions to alternative fuels.

TEA 21 also permits CMAQ funds to be used for public transportation and multimodal capital projects and transportation demand management projects. All of these funds are focused by the individual states on non-attainment areas within their respective jurisdictions. Personal travel needs for these funds have far exceeded availability; freight has in some cases (e.g. – California – Alameda Corridor) benefited from CMAQ allocations and appropriations, however, this has been relatively “hit or miss” case-by-case where freight issues have been addressed to some degree by virtue of being within non-attainment jurisdictions with resources available for matching purposes. The program to date has not been widely utilized for freight project purposes.

Other Federal-Aid Highway Programs that can benefit freight included in TEA-21 come under the general heading of “Federal Discretionary Grant Programs” Funding under discretionary programs are different in that they are administered by the Federal Highway Administration (FHWA) on a competitive basis rather than an entitlement basis predicated on formula allocations. Project applications are usually required in a format outlined through federal rule-making procedures. Notices of projects selected for award through these programs are provided to the States in November of each year for federal funding in the succeeding federal fiscal year. Discretionary projects are awarded on a federal fiscal year basis and must be committed by each state not later than September 30th of the year in which awarded or the funds may lapse or be subject to withdrawal depending on program requirements. All discretionary grants are subject to State Transportation Improvement Program and local Transportation Improvement Plan requirements. These programs have matching requirements and are subject to change given FHWA budget authority and the federal Secretary of Transportation’s discretion.
There are seven existing federally sponsored discretionary programs in addition to the National Highway System, and Surface Transportation programs under ISTEA and TEA-21, that may support and enhance commercial trade and transportation activities in the Nashville Area. Following is a synopsis of those discretionary programs that have, directly or indirectly, contributed to operational efficiency and/or capacity enhancement of transportation infrastructure benefiting freight:

**Bridge Program:** Title 23 United States Code, Section 144(g)(1)(2), and TEA-21, Sections 1101(a)(10) and 1207 provide for a federal discretionary bridge replacement, rehabilitation, or seismic retrofit of major bridges on the federal system. This program provides funding for bridges in addition to regular allocation and entitlements under the individual state’s apportionment under the National Highway Act. Federal share for this discretionary program can be up to 80% of total project costs. Allocations are made by competitive application among the states annually through state departments of transportation.

**Corridors and Borders Program:** TEA-21, Sections 1118 and 1119 provide for a discretionary corridor improvement program for approved infrastructure enhancements on select high priority trade corridors and international border infrastructure. Federal share is available up to 80% for approved projects however a “sliding scale” has been used in past appropriations to allow for more project enhancement and equity distribution. States, public/private consortiums, and metropolitan planning organizations are all eligible participants under the program although historically, since 1999, most funds have been earmarked for only a few mid-western state corridors. FFY 1999 through 2003 $700M has been allocated ($140M per year nationally). To date, approximately $50M of the allocation has been used for General Services Administration purchase, rehabilitation, and construction of border enforcement infrastructure. These authorization amounts are also subject to proportional reduction by the Secretary pursuant to TEA-21, Section 1102(f) relative to national budgetary targets.

**Interstate Maintenance Program:** TEA-21, Section 1107(b) provides federal discretionary funding for resurfacing, restoring, rehabilitating and reconstructing (4R Program), including adding travel lanes on existing Federal Interstate routes. Federal share for approved priority projects can be as high as 90%, but sliding scale matching ratios have been utilized in recent years to provide for more projects and to provide equity under the program. State Departments of Transportation are eligible applicants under the program. Since 1998 national allocations totaling $550M have been authorized.

**Value Pricing Program:** A relatively minor program, the discretionary Value Pricing Program authorized under Section 1012(b) of ISTEA, and Section 1101(a)(12) and 1216(a) of TEA 21 provides for up to 15 pilot programs for states, local governments, or public tolling authorities which include a variable pricing component that encourages shifts in time, route, or mode of travel from a congested location to another location. Federal share for approved eligible projects as determined by the Secretary is up to 80%. FFY 1999 through FFY 2003, $51M has been authorized and allocated nationally through the program.

**Federal Transportation Infrastructure Finance and Innovation Act Program (TIFIA):** Sections 1501-1504 of TEA 21 and Section 9007 of the TEA 21 Restoration Act provide for establishing
a transportation infrastructure finance and innovation act program that provides loans, lines-of-credit, and loan guarantees to select surface transportation projects of national or regional significance. Federal assistance, whether loan or line-of credit, is limited to 1/3 of total project costs. The fundamental goal is to leverage federal funding by attracting substantial private sector and other non-federal co-investment in making priority improvements to the nation’s surface transportation system. The US DOT awards credit assistance on a competitive basis to project sponsors including State Departments of Transportation, transit owner operators, special authorities, local governments, and private sector freight or passenger consortia.

The credit program may provide up to $10.6B in federal credit assistance through FFY 2003 at a maximum federal budgetary cost of $530M. This program is also subject to an annual obligation authority limit, at which about 90% will be available. To-date, FFY 1999 through 2003, $10.6B in credit limits have been supported by the $530M appropriation.

TIFIA projects must be included in both the Statewide Transportation Plan (STP) and the approved Statewide Transportation Improvement Plan (STIP). Various highway, transit, railroad, and intermodal projects may receive credit assistance under the program. Eligible highway projects include interstate construction, state highway construction, bridges, toll roads, and any other project that is eligible for federal grant assistance under Title 23 (Highways) of the U.S. Code of Federal Regulations. Transit projects encompass the design and construction of facilities, purchase of transit vehicles, and any other type of project that is eligible for grant assistance under Chapter 53 of Title 49 (Transit) of the U.S. Code. Additionally, intercity bus vehicles, railroad projects and facilities are eligible to receive assistance under current law. The design and construction of intercity passenger railroad facilities and procurement of intercity passenger railroad vehicles are both eligible uses of funds. Publicly owned intermodal facilities on or adjacent to the National Highway System are also eligible as are projects that provide ground access to airports or seaports.

A project’s “eligibility” to participate in federal funding under the program as defined in Title 23 U.S.C. 181 dictates that the project satisfies criteria for minimum size and that the 33 percent rule for total project costs requested applies. The project must be reasonably anticipated to total at least $100M excepting ITS/CVO projects whereby a $30M minimum cost rule applies. TIFIA requires that project financing shall be repayable, in whole or in part, from tolls, user fees and/or other dedicated non-federal revenue sources. Non-federal sources is defined as tolls, user fees, special assessments, tax increment financing, and any portion of a tax or fee that produces revenues that are pledged for the purpose of retiring debt on the eligible funded project. Other forms of collateral may be considered by the Secretary of Transportation on a case-by-case basis. Reimbursement from any other “federal source of revenue” is prohibited. Any transportation project sponsor, either public or private, may apply for this program’s credit financing.

*Intelligent Transportation Systems (ITS) Deployment Program:* Sections 5208 and 5209 of TEA 21 provide for a two part program of intelligent transportation system deployment and funding. Part 1 (Section 5208) provides for funding projects that demonstrate integration of multi-modal ITS components and technologies in metropolitan areas, rural areas, statewide or multi-state city settings to improve mobility, promote safety, enhance traffic flow, etc. including enhancing
existing and previously state or federally funded ITS projects. Maximum federal share for this program component is 50%.

Part 2 (Section 5209) is more focused to freight related and commercial needs through projects that demonstrate improvements to safety and productivity for commercial traffic including reducing costs associated with commercial vehicle operations and regulation. Maximum federal funding participation for this program is also 50%.

Both programs are administered through State Departments of Transportation and together for FFY 2000-2003 have been allocated over $461M. Both program components are subject to proportional reduction pursuant to TEA 21, Section 1102, budgetary appropriation limits.

**Fast Action Projects**

This study utilized a process that included feedback from regional freight stakeholders to identify freight oriented projects and improvements that were of immediate concern. The process included a presentation of all projects identified to the Freight Advisory Committee. Members of NFAC were asked to priority rank the complete list so that follow up by field investigations could be made on a reasonable number of projects. Most of these projects are low cost and provide significant improvements to local freight operations. These projects represent “Fast Action Projects” in the sense that they are achievable at a low cost and yield noticeable benefits for users. The top six projects selected by the advisory committee were:

- Beechcroft Road (SR 2247) at the CSX Crossing
- 8th Avenue Railroad Bridge
- Elliston Place
- Lebanon and Watertown: Exit 239
- New Shackle Island Rd. at Gallatin Rd (US Hwy 31)
- Old Hickory Blvd at Firestone Parkway

These projects were selected as the highest priority by the Freight Advisory Committee and are intended for possible inclusion in the MPO’s next Transportation Improvement Plan. Sketch-level project descriptions for these six potential projects appear in Part 1 of Appendix A. The complete list of all projects identified through the interview and field observation process are included in Part 2 of Appendix A.

Regional planning agencies, such as the Nashville Area MPO have historically focused planning on passenger/commuter transportation needs. The increasing need for freight transportation places an emphasis on understanding private industry behavior and needs. This study is intended to set the foundation and provide direction for future freight related planning and investment efforts.
This report was prepared by the Nashville Area MPO (NAMPO) in cooperation with the U.S. Department of Transportation (USDOT), the Federal Highway Administration (FHWA), and the Tennessee Department of Transportation (TDOT). The contents of this report reflect the views of NAMPO staff who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the FHWA, TDOT, or NAMPO. This report does not constitute a standard, specification, or regulation. FHWA or TDOT acceptance of this report as evidence of fulfillment of the objectives of this planning study does not constitute endorsement/approval of the need for any recommended improvements nor does it constitute approval of their location and design or a commitment to fund any such improvements. Additional project level environmental impact assessments and/or studies of alternatives may be necessary.